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AMERICAN MACHINIST

A JOURNAL FOR MACHINISTS, ENGINEERS, FOUNDERS, BOILER MAKERS, PATTERN MAKERS AND BLACKSMITHS.

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Improved Thirty-inch Planer.

The cut of planer which we show herewith represents the improved machine brought out by the Lodge & Davis Machine Tool Company, Cincinnati, Ohio.

The bed, as will be seen, is deep and of rather unusual length in proportion to that of the table, so that the latter does not project excessively when planing at full length. The distance between the Vs is made sufficient to prevent tipping of the table when taking heavy cuts at extreme sides.

The table is deep and rigid, with planed T-slots its entire length; holes are drilled and reamed from solid metal; holes are also bored at end of table outside the pockets, for convenience in planing work of unusual length. The Vs have a broad bearing surface, and are constantly supplied with oil by improved lubricating devices.

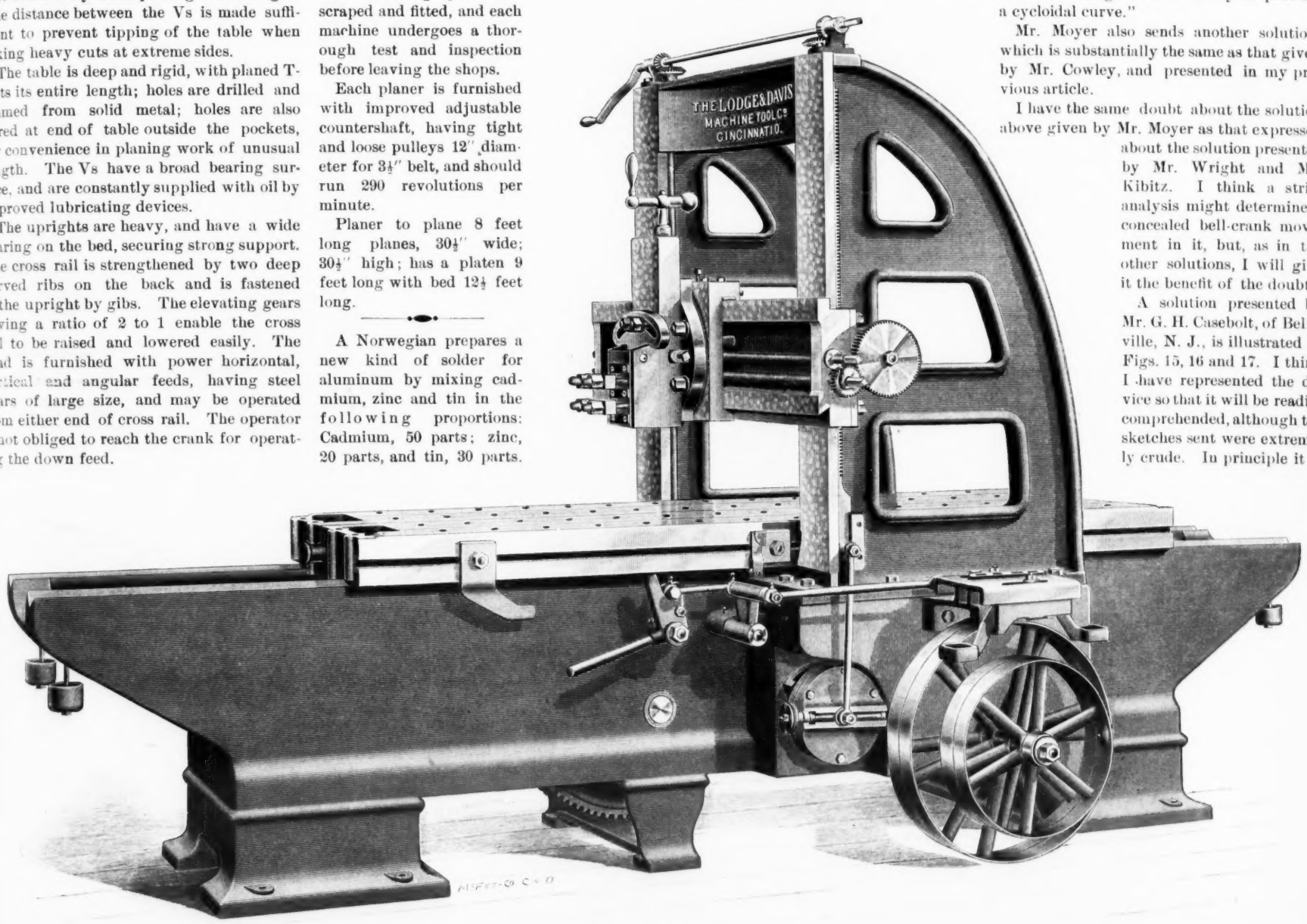
The uprights are heavy, and have a wide bearing on the bed, securing strong support. The cross rail is strengthened by two deep curved ribs on the back and is fastened to the upright by gibs. The elevating gears having a ratio of 2 to 1 enable the cross rail to be raised and lowered easily. The head is furnished with power horizontal, vertical and angular feeds, having steel gears of large size, and may be operated from either end of cross rail. The operator is not obliged to reach the crank for operating the down feed.

The bull wheel is keyed to the shaft, and this in turn revolves in long bearings of large diameter, improving the facilities for lubrication and avoiding foreign accumulations which sometimes result in the sticking or cutting of this gear. All gears and racks are cut from the solid stock. The gears are interchangeable and can be replaced at short notice.

All working parts are scraped and fitted, and each machine undergoes a thorough test and inspection before leaving the shops.

Each planer is furnished with improved adjustable countershaft, having tight and loose pulleys 12″ diameter for 3½″ belt, and should run 290 revolutions per minute.

Planer to plane 8 feet long planes, 30½″ wide; 30½″ high; has a platen 9 feet long with bed 12½ feet long.



IMPROVED THIRTY-INCH PLANER.

An improved shifting device makes it possible to return the table at a speed of four to one, the working, it is said, being without shock or jar, or disagreeable noise from belts, one belt being removed from tight pulley before the other engages it.

The dog can be lifted so the table may be run from under the tool to enable the operator to examine his work; the point of contact between shifter and dog is provided with steel rollers which prevents tendency to excessive wear at this point.

All driving shafts are made of crucible steel and run in phosphor-bronze journals. Each shaft with all its appurtenances may be taken out intact, when for any reason it is necessary to take the planer apart. The loose pulleys are also bushed with best bronze.

A Norwegian prepares a new kind of solder for aluminum by mixing cadmium, zinc and tin in the following proportions: Cadmium, 50 parts; zinc, 20 parts, and tin, 30 parts. The zinc is first melted in a crucible, the cadmium is then added, and the tin is put in last. The mass is well heated and stirred to secure an intimate mixture, and is then allowed to cool. The solder so produced is said to be applicable for soldering several different metals, but to be specially useful with aluminum.

The announcement was made a few weeks ago that Prof. Langley of the Smithsonian Institution had perfected what he believed to be a practicable flying machine. Nothing more than a working model has so far been constructed, however, this model not being large enough to carry passengers. There is considerable interest in hearing more of this machine. There is an opinion that a successful flying machine cannot be made.

On the Cultivation of Inventive Capacity by the Solution of Constructive Problems.*

BY LEICESTER ALLEN.

I come now to a solution, which, in one of its features, is entirely unique, and whereby uniformity of rotation when the sliding stock moves uniformly can be secured without the use of a belt, which cannot be done with either the solution given by Mr. Kibitz, the similar one of my own, or by Mr. Wright's second solution.

This interesting device is the contribution of Mr. E. A. Moyer, of Hartford, Conn., and is illustrated in Figs. 14 and 15 (page 2). I have to thank Mr. Moyer for his very pleasant letter, from which I quote the following explanation of his device:

"In Fig. 1 the spindle *A* has fastened to it, by a set-screw, the pinion *C*, which meshes with the larger bevel gear *B* that is supported by the bracket *E*. The gear *B* has on its side the roll *F* on a stud. The roll runs in in the curved slot in the guide *D*, which is stationary. It will be readily seen that, as the sliding head is moved forward, carrying the gear *B* with it, the roll *F* will follow the slot and rotate the gear in a right-handed direction, and in a reverse direction on the return stroke. The gear *B* is capable of about two-thirds of a revolution, if it is moved as far as the guide *D* will allow. To give the spindle a uniform motion, it will be necessary to make the slot in the guide *D* as nearly as possible a cycloidal curve."

Mr. Moyer also sends another solution, which is substantially the same as that given by Mr. Cowley, and presented in my previous article.

I have the same doubt about the solution above given by Mr. Moyer as that expressed about the solution presented by Mr. Wright and Mr. Kibitz. I think a strict analysis might determine a concealed bell-crank movement in it, but, as in the other solutions, I will give it the benefit of the doubt.

A solution presented by Mr. G. H. Casebolt, of Belleville, N. J., is illustrated in Figs. 15, 16 and 17. I think I have represented the device so that it will be readily comprehended, although the sketches sent were extremely crude. In principle it is analogous to that shown by Mr. Soper, but is not so good, because giving fewer rotations. The number of rotations will be found by dividing the distance through which the stock moves by the mean circumference of the bevel wheel on the spindle, whereas in Mr. Soper's solution there is a considerable multiplication of this motion.

In the figures *A* is a bracket with a central bearing *B* for the journal of the friction wheel *C*. The friction wheel *C* has a bevel on the margin of the front face to correspond with the bevel on the small friction wheel *D* on the shaft of the sponge spindle. The perimeter of the wheel *C* rolls on the guide, as shown in Figs. 15 and 16. This secures the motion called for in the problem, but the number of turns that can be attained in the spindle during the

* See issue of March 30.

sliding of the stock in this way will be less than can be attained by the simple cord belt movement presented by Mr. Gribben and others.

I yet have numerous solutions remaining unnoticed, and as it will be impossible to present them all in this article, I shall conclude it with a description of one forwarded by Mr. F. J. Curtis, of Pittsburgh, Pa, and a list of those who have sent in solutions substantially like those already given, reserving for a future number some which differ from those already presented. In this article I will also announce a new problem.

Mr. Curtis demonstrates that Connecticut is not the only State where ingenuity lies around loose.

Figs. 18, 19 and 20 illustrate this device. Fig. 18 is a partial side view, Fig. 19 an end view, and Fig. 20 a partial plan, the top piece of the sliding stock being removed the better to show underlying parts.

A is a bow-shaped rock-bar pivoted in the middle to the middle of the lower part of the sliding stock. One arm of the rock bar is slotted, as shown at *B*, Figs. 19 and 20, and through this slot passes a stud *C* that is inserted in one of the guides. The upper extremities of the rock-bar are connected by cords with the spindle, as indicated in Figs. 19 and 20. The sliding of the stock oscillates the rock-bar *A*, causing its extremities to sweep through an arc of considerable amplitude, and by careful designing I think this could be made the best working device for the special purpose named that has yet been offered. Everything about it can be made light, and yet strong enough for durability, and it can be made to rotate the spindle at a desirable velocity. Instead of the slot and pin *B* and *C*, I should, however, prefer a stud-pin set in the guide, a pin rigidly inserted in the arm of the bent rock-bar, and a link or connecting rod fitted to the pins. A pin, sliding in a slot, is apt to wear rapidly.

Mr. O. E. Overpeck, of St. Louis; Mr. F. Van Fleet, of Williamsport, Pa.; Mr. Robert Clegg, of Providence, R. I.; and Mr. M. Jacker, of Chicago, Ill., have each solved the problem correctly, their solutions being substantially like that of the second one presented by Mr. Gribben in the issue of Feb. 23.

Mr. W. H. Freeman, of San Francisco, Cal., correctly solved the problem, his solution being almost identical with that of the first one presented by Mr. Gribben; and a similar solution was sent in by Mr. C. E. Sargent, of Chicago, Ill., in whose solution, however, there is a somewhat different arrangement of idlers. A similar solution has also been received from Mr. J. K. Love, of Newark, N. J.

Solutions, substantially like that given by Mr. Cowley in my previous article, have been furnished by Mr. Geo. W. Drake, of Cleveland, Ohio; Mr. Adam Gerlock, of Philadelphia, Pa.; Mr. James Tobin, of Brooklyn, N. Y.; Mr. Charles S. Beach, of Bennington, Vt.; Mr. W. M. Hoerle, of Allegheny, Pa.; Mr. Henry F. Noyes, of Elgin, Ill.; Mr. A. S. Mallory, of Camden, N. J.; Mr. Wendell P. Tarbell, of Milford, N. H.; Mr. A. Grossman, of Brooklyn, N. Y.; and Mr. C. E. Quimby, of Tilton, N. H. Slightly different arrangement of parts which do not affect the general principle are found in some of these solutions.

Mr. James P. Hayes, of Meriden, has sent in a solution substantially like that of Mr. Graves, above given.

Mr. Drake, whose name is included among those who adopted the same method as Mr. Cowley, writes:

"The constructive problems that have appeared in the American Machinist have interested me very much. I am clipping out the solutions, and placing them in my box of clippings entitled '*Mechanical Movements.*' I consider them a valuable addition to my stock, and trust I may add many more to it."

Mr. Quimby, also named among those whose solutions resemble Mr. Cowley's, in his letter to the editor inclosing his solution, also writes:

"I want to thank you and Mr. Allen for this department, and I can truly say that I am more interested in it than in any series of articles published in the six years that I have had the paper. Hence, although I am but one, I wish to show that I appreciate the opportunity by attempts at solutions."

Such words of encouragement as these, which are but samples of a great many, are very pleasant to receive.

I herewith announce another problem, which I confidently expect will bring out one or more mechanical movements fully as unique as those given in response to the triangular motion problem. At first sight, I think many will be apt to regard this problem as impossible. I assure any who entertain any such doubt, that I shall give out no problems of which I have not proved the possibility of solution, by first solving them myself.

PROBLEM.

In Fig. 21, two disks, *A* and *B*, are keyed to the ends of two parallel shafts fitted to turn in fixed bearings. *A* required to drive *B* by mechanism subject to the following restrictions:

1. If any point, as *a*, be taken in *A*, at a given distance from its axis of rotation, any point, as *b*, taken in *B*, at the same distance from its axis of rotation, must have, at any time, the same velocity of rotation that *a* has, or, as books on mechanics would put it, the velocity ratio of these points must be 1.

2. This is now done in coupled driving

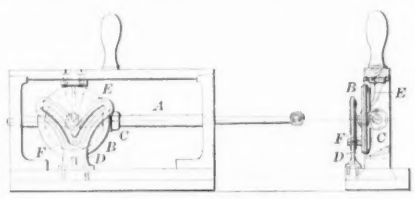


Fig. 14

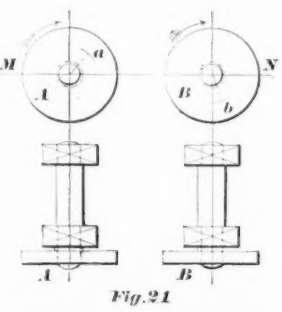


Fig. 21

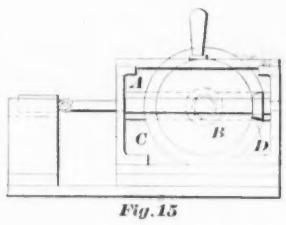


Fig. 15

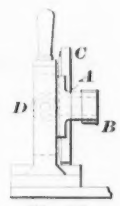


Fig. 16

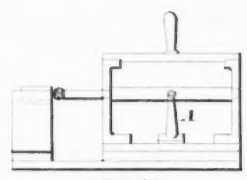


Fig. 18

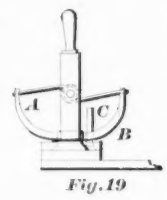


Fig. 19

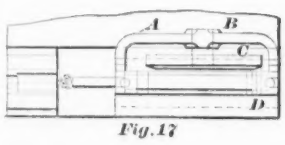


Fig. 17

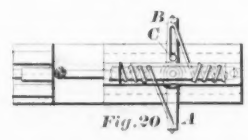


Fig. 20

wheels of locomotives by two cranks (or their equivalents) on each shaft, the cranks being set at an angle with each other—usually a right angle—and two coupling rods, but it must be understood *that such a device is rigidly excluded in the solution of this problem.*

3. Belts of any kind, toothed gearing, friction wheels, or sprockets are excluded.

4. The motion of the driven wheels must be continuous and in the same direction as that of the driver, so long as the driver continues to move in that direction. The direction of rotation is not required to be reversible, but if it can be made so it will be a desirable feature in such a movement.

5. There must be no dead point in the driven wheel; when the driver starts to rotate, the driven wheel must start also, no matter what position any point in it may occupy relative to the line of centers *M N*.

6. The motion desired is extremely slow—one rotation of the driven wheel in 30 minutes—and as the wheels are only one inch in diameter, and the distance between their centers is 1½ inches, the mechanism may be extremely light. However, as there may be cases wherein a stronger movement of this kind might be desirable, I will add that the problem practically admits a solution for much larger wheels and higher velocities.

The restriction that no toothed wheels, belting of any sort, or friction wheels are allowable, relates to *the immediate connection between the driving wheel A and the driven wheel B.* The driving wheel may itself be driven by any means desired.

While solutions employing mechanism not carried by either the wheel *A* or *B*, or both of them, or by their shafts, will not be rejected, if they do not overstep other restrictions, I will say that those solutions will be considered best that use only devices attached to and connecting the two wheels. The problem admits of a very neat solution in this way, and I hope this method will be perceived by many who will take the problem into consideration. Should this be doubted, I will submit to the editor of the American Machinist my own solution in advance of any that may be forwarded to me, leaving him to say whether I am in error or not.

A Denial.

The fact that there has been a good deal published in regard to extortions which it has been intimated would be practiced at the World's Fair, has induced President Higinbotham to write the following, which we take from the Chicago *Tribune*. The *Tribune* says:

President Higinbotham, of the World's Fair, took up his pen yesterday and attached his signature to an official statement which will set the public right on eight important points in regard to the Exposition management. For several weeks misleading stories have appeared in the public prints. The burden of them has been that wherever a visitor to the Fair would turn he would be obliged to pay a fee. It has even been stated that nothing could be enjoyed at Jackson Park without cost except air. In view of the general publicity and wide misapprehension of the facts, President Higinbotham yesterday issued the following:

World's Columbian Exposition, Chicago, March 30, 1893.—To the Public: Because of many misrepresentations and misstatements relative to Exposition management and affairs being in circulation through the press and otherwise, both in this country and abroad, and in reply to many letters of inquiry or complaint touching the same matters, it seems advisable that some official statement regarding them should be made to the public. Therefore I respectfully ask that the widest publicity be given to the following facts:

1. The Exposition will be opened in readiness for visitors May 1.

2. An abundance of drinking water, the best supplied to any great city in the world, will be provided free to all. The report that a charge would be made for drinking water probably arose from the fact that hygeia water can also be had by those who may desire it at one cent a glass.

3. Ample provisions for seating will be made without charge.

4. About 1,500 toilet rooms and closets will be located at convenient points in the buildings and about the grounds, and they will be absolutely free to the public. This is as large a number in proportion to the estimated attendance as has ever been provided in any exposition. In addition to these there will also be nearly an equal number of lavatories and toilet rooms of a costly and handsome character as exhibits, for the use of which a charge of five cents will be made.

5. The admission fee of 50 cents will entitle the visitor to see and enter all the Exposition buildings, inspect the exhibits, and, in short, to see everything within the Exposition grounds, except the Esquimau Village and the reproduction of the Colorado cliff dwellings. For these, as well as for the special attractions on Midway Plaisance, a small fee will be charged.

6. Imposition or extortion of any description will not be tolerated.

7. Free medical and emergency hospital service is provided on the grounds by the Exposition management.

8. The Bureau of Public Comfort will provide commodious free waiting rooms, including spacious ladies' parlor and toilet rooms in various parts of the grounds.

H. N. Higinbotham, President.

Commenting on Mr. Higinbotham's statement the *Tribune* says:

President Higinbotham in his statement might have been more specific on a number of facts. The drinking water which will be supplied free is to be either filtered or sterilized. The process of sterilization is accomplished by boiling the water. This has been done for months at the grounds to supply the laborers and others engaged at work there. Months ago the Exposition company made a contract for something less than 3,000 drinking fountains. These fountains have each four faucets, so that 12,000 people may drink at the same time. These fountains will be distributed all over the ground, and, as has been indicated, the water will be either filtered or sterilized. The Hygeia Company is merely a side issue in dispensing water. It was permitted to build a great many booths about the ground simply for the accommodation of those who wish to drink mineral spring water rather than that from Lake Michigan.

The 1,500 free toilet rooms and closets will be immediately contiguous to those for which a fee of five cents is charged. With the fee is included lavatory privileges. Both the free and the fee rooms will be first-class, and the visitor may take his choice.

Imposition or extortion is not practicable, because every person having the right to sell goods or meals is bound by the rules of the Exposition company. The concessionaire who has the restaurants on the grounds is subject always to the supervision of Exposition officials. The prices charged for food must be approved by the authorities, and in this case the persons to fix the prices are the members of the Ways and Means Committee, which granted the concession. Before Mr. Higinbotham became president of the Exposition he was the chairman of this Ways and Means Committee. Then, as now, he approved all contracts, and what he says in his statement comes from a knowledge of the facts.

FREE HOSPITALS.

Free medical and emergency hospitals will be provided in different portions of the grounds. Great forethought is being exercised in this particular, just as was the case last October on dedication day. Then, at much expense, hospitals were provided free in several of the buildings for that day to secure prompt attention in case of mishaps to visitors.

The Bureau of Public Comfort is a part of the Exposition management. A special building for its use is now being constructed at the north end of the park. At the south end, in the big terminal station, where all the passengers outside Chicago to the Fair will land, the Bureau has been given a great number of rooms in which will be furnished free accommodations. At the southeast corner of the park, in the Casino Building, more room has been reserved for this same Bureau of Public Comfort. In each of these buildings will be cheap lunch counters, checking-rooms, barber shops, etc., and tables where those who feel so inclined may sit and eat the luncheon which they bring to the park.

Fifty cents—no more, no less—will entitle the visitor to see every exhibit in Jackson Park, and if he bring a luncheon with him he may get through without any additional expense.

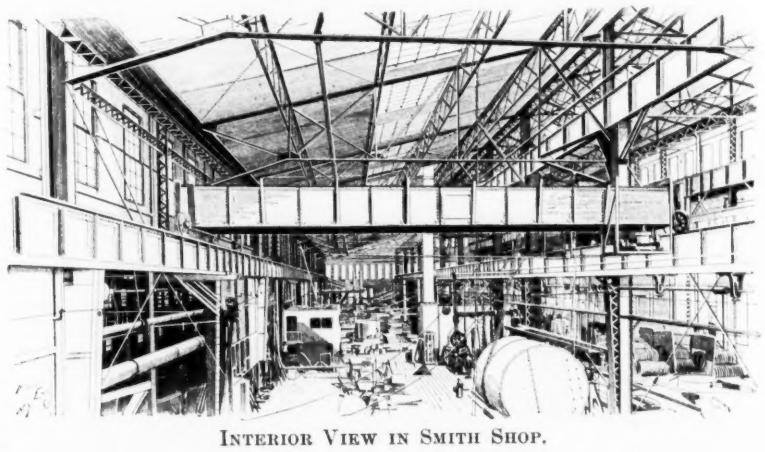
Messrs. A. W. Jacobi and G. V. C. Vreeland, of Newark, N. J., have recently bought the machine shop formerly owned by Mr. John Enright, at the corner of N. J. R. R. avenue and Hamilton street, Newark, and will run it as a general jobbing and contract machine shop. Mr. Jacobi is a well-known mechanic and engineer, for a year or two in consulting practice in this city and formerly chief draftsman and engineer at the Hewes & Phillips Works, Newark. Mr. Vreeland's experience has been as a machinist working on engine and special tool work. Their shop, which will be moved one block to better quarters at N. J. R. R. avenue and East Mechanic street, sometime this month, is well equipped, and there is every reason to believe that the young men who are starting in business with it will be entirely successful.

The New Boiler Shop of Wm. Cramp & Sons.

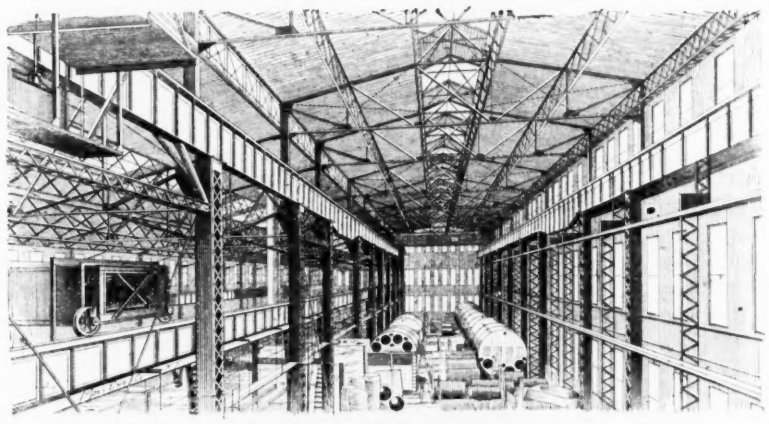
We give with this illustrations of the new boiler shop recently constructed by Wm. Cramp & Sons' Ship and Engine Building Co., Philadelphia, Pa. The shop was designed and built by the Berlin Iron Bridge Co., of East Berlin, Conn. It is 115 feet in width and 350 feet in length. The building is divided into two parts, and while it is known as a boiler shop, yet one-half of the building is a smith shop and the other half is a boiler shop. In the construction of marine boilers, as is well known, the diameter of the boiler is very large as compared with the ordinary stationary boiler, and it is necessary in order to move boilers lengthways of the shop over each other that the lift under the traveling crane shall be at least 40 feet. The height of the main portion of this boiler shop is 59 feet to the underside of the roof trusses, and 52 feet to the top of the traveling crane girder, giving a lift height of a little over 40 feet under the crane girder. The building is designed for two 50-ton cranes, with a travel the full length of the building, so that by uniting the two cranes a load of 100 tons can be moved in any part of the building. The smith shop is 60 feet in width, and 20 feet longer than the boiler shop. This is supplied with a crane of 20 tons capacity, with a travel the full length of the building, so that material can be moved anywhere about the floor surface.

The interior of the building is lighted from windows in the sides, as well as from alternate skylights in the ventilator, so that a well-diffused light is distributed throughout every part of the building. The windows in the side walls are well shown in the outside view of the building, they being placed as close together as practicable, and their size being as large as would be consistent in a construction of this kind. This avoids a weakness altogether too common in boiler and machine shops, viz., poor light from small windows injudiciously placed.

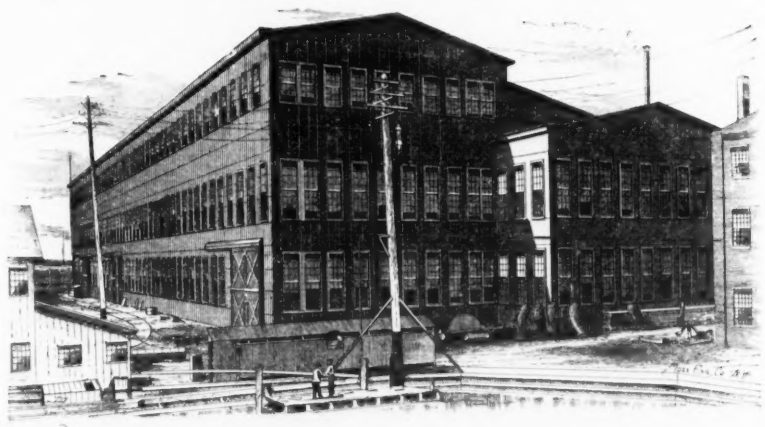
The illustrations give so clear an idea of the entire construction of the building as to make a more detailed description unnecessary.



INTERIOR VIEW IN SMITH SHOP.



INTERIOR VIEW IN BOILER SHOP.



THE NEW BOILER SHOP OF WM. CRAMP & SONS.

Performance of Injectors.

Some time since we addressed the following note to manufacturers of injectors:

GENTLEMEN: An inquiry has been addressed to us, which we think is entitled to a more complete and authentic answer than we are able to give off-hand. We are, therefore, addressing a duplicate copy of this letter to each manufacturer of injectors in the country, and will thank you to write us, with liberty to publish your reply, in answer to the following question:

What has been the best performance of the injector in raising or lifting water to any height? That is, the greatest volume or weight of water raised, relative to height, with a given weight of evaporated water (steam). Also the pressure of steam and temperature of water before raising?

Of course you will appreciate that what is wanted is a record of actual performance, with statement of where and when done, and under what circumstances.

Yours truly,

———.

We have not received so much information on the subject as we had hoped for, but publish below such as we have received relating to the points about which we sought information:

William Sellers & Co. (Incorporated), Philadelphia, say:

In answer to the inquiry contained in your letter of the 29th ulto., as to "the best performance of an injector in raising or lifting water to any height, that is, the greatest volume or weight of water raised, relative to height, with a given weight of evaporated water (steam), also the pressure of steam and temperature of water before raising," we would say that, in one of our tests made some two years since, the injector delivered 25.51 pounds of water into the boiler with one pound of steam; gauge pressure was 65 pounds, the water at 64° temperature flowing to the injector under one foot head.

Nathan Manufacturing Co., New York, say:

In reply to your inquiry of the 29th ulto., concerning the "best performance of injectors in raising or lifting water to any height, that is, the greatest volume or weight of water raised, relative to height, with a given weight of evaporated water (steam), also the pressure of steam and temperature of water before raising," we beg to state that injectors, as a rule, are not used for the purpose of raising water. The main purpose of an injector is that of an automatic boiler feeder (replacing the former boiler feeding pump). In the greater majority of instances, the lifting required to be done by such boiler feeders is very moderate, and there has not been any occasion to make quantity tests at the greatest height to which an injector could be relied upon to raise feed water. The steam consumption, also, of an injector as a boiler feeder is of very slight importance, because the main advantage of injectors over feed pumps is not the mechanical power developed, but the caloric effect, which is the principal consideration of an injector intended to keep the boiler supplied with water at a high degree of temperature, which is of the utmost beneficial effect on boiler space and tubes. The amount of steam used by an injector is, therefore, of very slight importance, because this apparatus practically loses no heat, but returns the steam needed for its working to the boiler in the shape of hot feed water, which, in its turn, makes just so much less demand upon the fire to bring it up to the point of steam generation. For this reason evaporating tests have never been called for, and would only have the remotest scientific and theoretical value.

From the tenor of the inquiry, we are rather inclined to believe that it may perhaps be the performance of an ejector which is desired to be known rather than that of an injector. Ejectors are used for the purpose of lifting or raising water, and of conveying it from one place to another. In these cases the consumption of steam—proportionate to the amount of water raised, lifted or conveyed—is of quite some importance, since all the steam used is practically lost, being employed in producing a certain mechanical effect only. The unavoidable raising of the temperature of the feed water in the case of an ejector is incidental, and, in the majority of cases, not even desired, so that, as a rule, it cannot be considered a useful result.

J. E. Lonergan, Philadelphia, says:

Your letter of December 29th, 1892, relating to injectors, was received in due time. It became mixed with other papers, and was set aside and overlooked till now. However, you have lost nothing, as the writer's efforts in the manufacture of injectors have not been directed to securing excessive high lifts of water, but a medium lift, say 12 or 15 feet, and a strong forcing power, there being the greatest demand for this class of instrument.

I have been content, therefore, to confine my experiments to this class of instrument.

Schaffer & Budenberg, New York, say:

Referring to your inquiry of December 29, 1892, we now give you as promised some data regarding our peerless automatic restarting injector. From tests made at our works at Magdeburg, Buckau, Germany, our injectors will lift by suction water having temperatures of 140 degrees Fah. if the boiler pressure is between 30 and 60 pounds per square inch; 136 to 133 degrees Fah. if the boiler pressure is between 60 and 90 pounds per square inch; 122 to 118 degrees Fah. if the boiler pressure is between 90 and 120 pounds per square inch; 113 to 107 degrees Fah if the boiler pressure is between 120 and 150 pounds per square inch; 107 to 104 degrees Fah. if the boiler pressure is between 150 and 180 pounds per square inch; 104 to 100 degrees Fah. if the boiler pressure is between 180 and 195 pounds per square inch; 100 to 95 degrees Fah. if the boiler pressure is between 195 and 225 pounds per square inch; and they do not stop working even if with a pressure of 30 pounds the water supply is throttled. With low pressures the capacity is comparatively greater than with high ones.

If the water is not too warm, say not exceeding 86 degrees Fah., the injector will force against a pressure up to 75 pounds higher than that of its working steam. With water of higher temperatures the difference must not be so great.

To force one gallon of water into the boiler requires from 0.4 to 0.8 pounds of steam.

The lower the pressure is against which the injector is required to work the less will be the quantity of steam used; however, such decrease does not take place quite in the same proportion.

The Hancock Inspirator Co., Boston, say:

Replying to your favor of the 29th of December relative to the duty of an injector or inspirator, we take pleasure in giving you the following data taken from quite an extended series of experiments made in our laboratory by and under the direction of the Massachusetts Institute of Technology in 1886.

We have selected from this data the following table which we think will give you the information desired:

Lift in feet.	Boiler pressure absolute above 0.	Temperature of Suction Fah.	Temperature of Delivery Fah.	Lbs. of water fed per hour.	Lbs. water delivered per hour.	Steam used per hour.	Water fed per lb; steam calculated by heat.	Water fed per lb. of steam.
22	75.81	34.88	133 95	1627.85	1775.58	147.73	10 815	11 019
22	54 06	35.42	117 14	1454.54	1560.97	106 43	13 240	13 666
22	95.47	47.30	173.70	1402.41	1573.77	171.36	8.186	8 184
11	75 38	53 20	131.09	1785.71	1920.00	134 29	13.786	13 298

In June, 1879, R. H. Buell made the following experiment with a No. 20 Hancock inspirator. With steam pressure of 63 pounds he lifted water 27 feet, delivering water against pressure equal to steam, and the instrument continued to work until the pressure was 95 pounds. Then steam and water pressure were simultaneously reduced to 10 pounds, and then again increased to 70 pounds, when the inspirator ceased to work. Temperature of supply water was 70 degrees Fah. We have made no recent experiments in the line desired by you, but think we could show perhaps better duty than the above with our present improved apparatus.

Belfield & Co., Philadelphia, say:

Answering yours December 29th, we are unable to answer your inquiry intelligently. Our efforts have been directed in the injector line to perfecting a locomotive injector that would have great range of capacity; *i. e.*, from the maximum quantity of water it would be capable of throwing to the minimum capacity, and also to get an injector that will not be liable to "break off."

As locomotive injectors are not required to lift over 5 feet, the question of lifting was of secondary consideration. Other makers have given the question of lifting considerable attention, which is important in stationary service.

The Penberthy Injector Company, New Albany, Ind., send us a report made to them by J. F. Elson, from which we extract as follows:

DATA AS SHOWN BY APPLIANCES USED.

Pressure	85 pounds.
Temperature	316.021 deg.
Heat units	1178.336
Latent heat	891.286
Weight cubic foot of steam	.3010
Volume	5.05
Temperature of feed water	160. deg.
Saving in fuel, per cent	6.64?

This means over any appliances used for kindred purpose, and based on the actual heat units absorbed in injecting water into the boiler at above pressure. . . .

The flow of steam through the injector at the pressure named shows the parts to be finely adapted to each other, obstructions, such as imperfectly working parts, undue friction and unequal expansion as reduced to the minimum:

Pressure	100 pounds.
Size of pipe	¾ inch.
Weight of steam per M	2.95 pounds.
Loss of pressure	1 pound.

. . . . .

The actual lift of this injector with distilled water is 24 1/2 feet, according to the demonstrations already made by others as well as myself. . . .

You ask what is the actual efficacy of this one based on this particular test. In answer will state a great many would state it very high, to attain which it would be necessary to sacrifice other characteristics, which, in

my opinion, should not be ignored in tests of this kind; hence I do not feel like reporting over ninety-nine and twenty-two hundredths ($99\frac{22}{100}$), though as before stated, a better showing could be made if we cared to ignore some of the little things which go to make up a grand total.

A Plain Slide-valve Engine.

This engine, of which we give two views, is built by the Batavia Steam Pump and Engine Works, Batavia, N. Y. The one shown has a cylinder 6¼″ diameter; stroke of piston 9″. These engines are, however, built in the same general style of larger sizes.

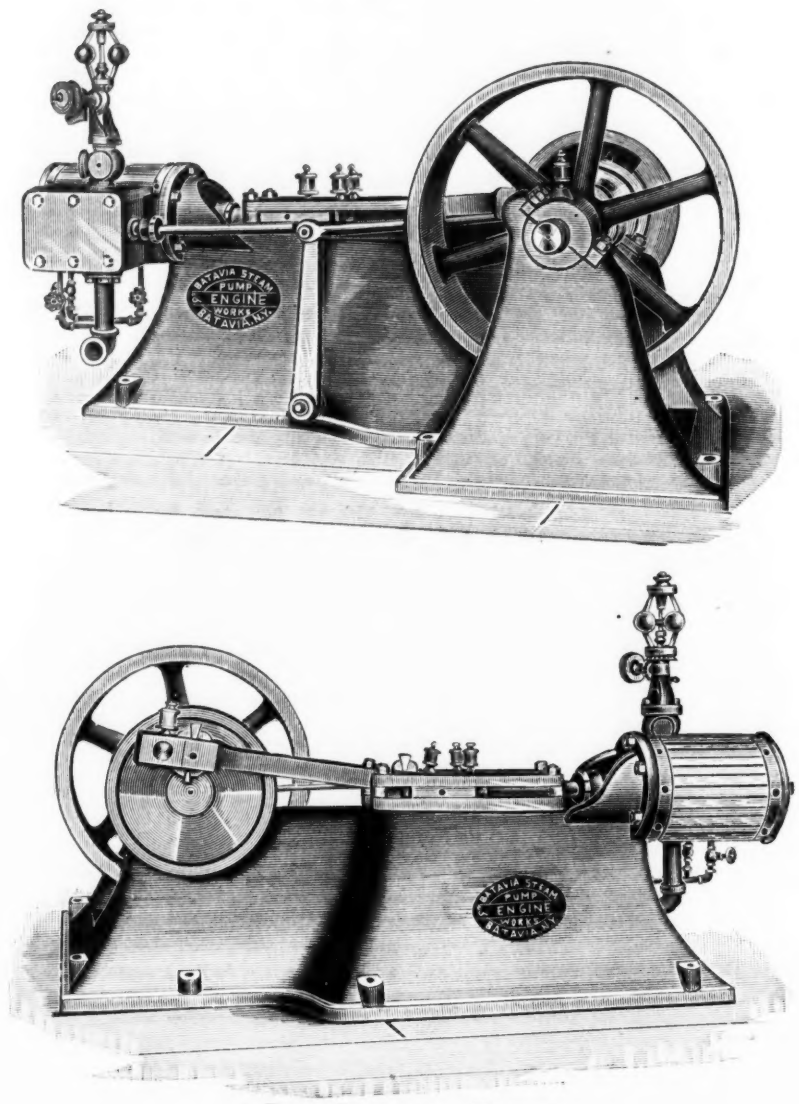
The bed-plate is a solid or continuous casting, making the engine self-contained and easily set in place without special foundation.

The cylinder is made extra thick and heavily counterbored for convenience of reboring two or three times if necessary. The bottom of the ports are lower than the bore of the cylinder, so that water is prevented from accumulating and causing injury. The cylinder cocks are so placed as to insure drainage of both cylinder and steam-chest. The valve, as the title states, is a plain slide.

The guides are of the locomotive type, being fastened to the bed-plate with studs, and can, of course, be readily placed in line when wear occurs. The crosshead is long —7″ in the engine shown—and the pin is located in the center. The piston rod is screwed into the crosshead and secured by a jam nut. The arrangement of the connection from the eccentric to valve rod is clearly shown. The rocker is 18″ long and has a motion of 2¾″ which does not throw the rods out of a straight line to an injurious extent.

The crank wheel is 16″ diameter, is counterbalanced for smooth running at high speed and to prevent vibration. The crank-pin is 1½″ diameter. The shaft is 2½″ diameter, length of crank-wheel journal 6″, length of fly-wheel journal 5″. The balance wheel is 30″ diameter with 8″ face.

The straps and stub ends of connecting rod are fitted with two gibs and a key, the builders considering this a preferable form of construction.



A Plain Slide-valve Engine.

The Cost and the Value of Compressed Air.

By Frank Richards.

Those of us who are not wise enough to consider well before buying it what a thing will be worth to us, are very apt to be looking it over anxiously after the purchase to see what sort of a bargain we have got. So, as in our last paper we got at the approximate power cost of a cubic foot of compressed air at a given pressure, we naturally now want to know what it is worth to us. Well, if we know what it costs, we know by that what it is worth. Not necessarily; and, in this case, decidedly not. For by that measure it costs too much, and yet we go on using it more and more. And our bargain is really worse than appears thus far; for if we take our compressed air and go to use it as we use steam, or if we substitute it in a place where we have been using steam, we soon find that a cubic foot of air at a given pressure is not worth as much, in power, as a cubic foot of steam at the same pressure.

The accompanying diagram, Fig. 1, shows how this can be so. Here we have one volume of steam and the same of air, both at 100 pounds gauge pressure, and each successively expanded through several volumes until the pressure of each falls below atmosphere. It is readily seen that the two expansion lines are very different, and that the mean effective pressure of the steam is decidedly higher than that of the air. Thus one volume of steam at 100 pounds, represented by the length of the line *A* 1, reaches atmospheric pressure after expansion to about six and a half times the original volume, while the same volume of air drops to the same pressure after expansion to a little over four times its original volume.

This diagram is equally applicable for any other initial pressure, below 100, by taking as the measure of volume the length of a horizontal line drawn from the line *A B* to the expansion line at the given pressure, and taking each repetition of this length, horizontally, as representing an additional volume. Thus at 60 pounds pressure one volume of steam is represented by 1½, and two volumes would be represented by 3, and at the intersection of the vertical line marked 3 we find that the steam pressure has fallen to about 21 pounds, which is nearly correct. We may take any section of this diagram as representing, theoretically, an indicator card either for steam or air, but we cannot take both the steam and the air cards and compare them by placing one upon the other, because the lengths of the two cards will not coincide.

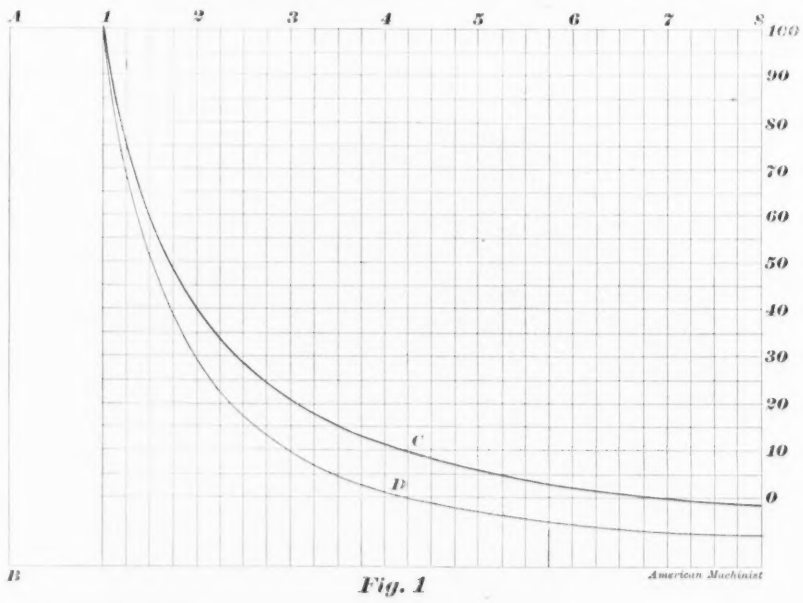


Fig. 1

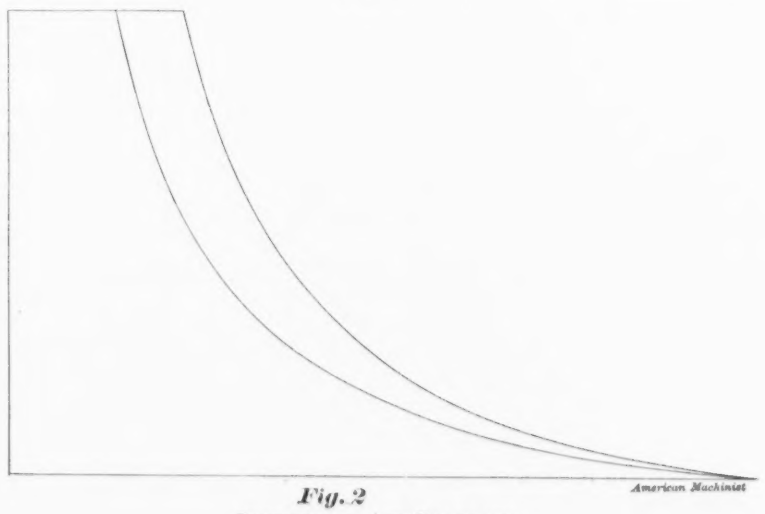


Fig. 2

Compressed Air Diagrams.

Fig. 2 is a theoretical card, scale 40, showing both steam and air expanded to atmosphere at the end of the stroke. In this case the air line is outside and above the steam line, and, of course, represents a higher mean effective, but it is at the expense of a much larger initial volume. The mean effective for air filling the cylinder at initial pressure of 100 for a sufficient portion of the stroke and then expanding (without loss or gain of heat) so that it reaches atmosphere at the end of the stroke will be 41.6 pounds. The mean effective for steam under the same conditions will be 32.46. The volume of air used will be .2353, while the volume of steam will be .1471. The air to be of equal value with the steam should be:

.1471 : .2353 : : 32.46 : 51.9.

Then, 41.6 : 51.9 : : 100 : 124.7,

which gives the steam nearly 25 per cent. the advantage.

I offer herewith a table showing the mean effective and terminal pressures for both steam and air at various points of cut-off and for different gauge pressures from 50 to 100. All pressures given in the table are gauge pressures, except where they fall below atmosphere, when the absolute pressures are given and printed in *italics*. It is thought that in this way the table will be more serviceable to the general mechanic than if the entire table were given in absolute pressures.

50.

Point of Cut-off.	Mean Steam Pressure.	Mean Air Pressure.	Terminal Steam Pressure.	Terminal Air Pressure.
.05	*12.12*	*8.87*	*2.69*	*.95*
1/16	*14.39*	*10.8*	*3.41*	*1.31*
.10	5.44	1.2	*5.63*	*2.54*
1/8	8 95	4.51	*7.13*	*3.47*
.15	10 18	7.62	*8.65*	*4.49*
3/16	16 55	11.96	*10.97*	*6.14*
.20	17 9	13.84	*11.75*	*6.74*
.25	22 83	18.45	*14 9*	*9.23*
.30	27.11	23 05	3 08	*11.93*
1/6	29 66	25 84	5.22	*13.83*
.35	30 86	27.17	6 3	*14.82*
3/8	32 56	29 07	7 92	1.34
.40	34.15	30.87	9 55	2 88
.45	37 04	34 18	12 84	4 11
.50	39 54	37 12	16 12	7 40
.60	43 61	41 98	22.77	16 66
5/8	44 44	42 99	24 44	18 53
7/8	45 67	44 52	27 24	21 73
.70	46 54	45.6	29.49	24.31
.75	47 64	46.98	32 88	28 34
.80	48.52	48 08	36 27	32 47
7/8	49 43	49 26	41.4	38 85
.90	49.64	49 53	43.11	41.03

60.

Point of Cut-off.	Mean Steam Pressure.	Mean Air Pressure.	Terminal Steam Pressure.	Terminal Air Pressure.
.05	*13.99*	*10.23*	*3.1*	*1.1*
1/16	1 61	*12.46*	*3.93*	*1.51*
.10	8 58	3 69	*6.49*	*2.93*
1/8	12.64	7.51	*8.22*	*4.01*
.15	16.37	11.1	*9.99*	*5.21*
3/16	21.41	16 11	*12.66*	*7.08*
.20	22.96	17.7	*13.56*	*7.77*
.25	28.75	23 6	2.19	*10.65*
.30	33 59	28.9	5.87	*13.77*
1/6	36 54	32.13	8 34	.96
.35	37.92	33.66	9 58	2 33
3/8	39 87	35.85	11 8	3.85
.40	41 71	37 93	13 22	5.64
.45	45.03	41 75	17.1	10.71
.50	47.94	45.14	20.91	13 26
.60	62.62	50.75	28.59	21.53
5/8	53 58	51.02	30 51	23 69
7/8	55 01	53 67	33.74	27.94
.7	56.01	54.93	36 34	30 30
.75	57.28	56 52	40.24	35 01
.8	58.29	57.79	44 05	39.78
7/8	59 34	59 15	50 07	47.14
.9	59 58	59 46	52 05	49 65

70.

Point of Cut-off.	Mean Steam Pressure.	Mean Air Pressure.	Terminal Steam Pressure.	Terminal Air Pressure.
.05	1.06	*11.6*	*3.52*	*1.23*
1/16	3.82	*14.12*	*4.46*	*1.71*
.10	11.73	6.19	*7.36*	*3.32*
1/8	16.33	10 51	*9.32*	*4.54*
.15	20.55	14 58	*11.32*	*5.88*
3/16	26.26	20.25	*14.37*	*8.03*
.20	28 02	22 06	.37	*8.81*
.25	34.47	28.74	4.49	*12.07*
.30	40.07	34 75	6.65	.6
1/6	43.41	38.41	11.45	3.09
.35	44 97	40.15	12 86	4 38
3/8	47.19	42.63	14.98	6.36
.40	49 27	44 99	17.1	8.39
.45	53 04	49.31	21.38	12 61
.50	56.33	53.16	25.69	17.
.60	61.64	59.51	34.4	26 4
5/8	62.73	60 84	36 58	28 85
7/8	64 34	62 83	40.24	33 03
.70	65.48	64.25	43.19	36 44
.75	66 92	66.05	47 61	41.68
.80	68.07	67.5	52 05	47 08
7/8	69.26	69.03	58.75	55.43
.90	69.53	69.38	60 99	58.27

80.

Point of Cut-off.	Mean Steam Pressure.	Mean Air Pressure.	Terminal Steam Pressure.	Terminal Air Pressure.
.05	2.72	*12.96*	*3.93*	*1.39*
1/16	6.04	.78	*4.98*	*1.92*
.10	14.87	8.68	*8.22*	*3.71*
1/8	20.01	13.51	*10.42*	*5.08*
.15	24 73	18.06	*12 65*	*6.57*
3/16	31.12	24 4	1.01	*8.97*
.20	33.08	26.6	2 18	*9.85*
.25	40.29	33.89	6.78	*13.49*
.30	46 55	40 61	11.43	2.44
1/4	50 28	44 69	14.56	5 22
.35	52.03	46.64	16 14	6.66
3/8	54.51	49.41	18.5	7 88
.40	56.83	52 05	20 88	11 14
.45	61.04	56 9	25.66	15 86
.50	64 72	61 18	30 48	20 81
.60	70.76	68 28	40.21	31.27
5/8	71.87	69 76	42.65	34 01
2/3	73.68	71 99	46 74	38 68
7/8	74.95	73 57	50.03	42 49
.7	76.56	75 59	54 97	48 35
.75	77.84	77.2	59.94	54 38
.8	79.17	78.92	67.43	63 81
7/8	79.47	79.31	69.93	66.89

90.

Point of Cut-off.	Mean Steam Pressure.	Mean Air Pressure.	Terminal Steam Pressure.	Terminal Air Pressure.
.05	4.59	*14.33*	*4.34*	*1.54*
1/16	8 25	2 95	*5.51*	*2 12*
.10	18.02	11.17	*9.09*	*4.1*
1/8	23 7	16.52	*11.51*	*5.61*
.15	28 92	21.55	*13 98*	*7.26*
3/16	35 97	28 55	2.73	*9.92*
.20	38 15	30.78	3 99	*10.88*
.25	46 11	39 64	9 07	*14.91*
.30	53.02	46.46	14 22	4 27
1/4	57.17	50.98	17 67	7 35
.35	59.08	53 13	19.42	8 95
3/8	61 82	56 2	22 08	11 39
.40	64 4	59 11	24.65	13.88
.45	69 05	64 45	29 95	19.11
.50	73.11	69.19	33.27	24 56
.60	79.67	77.05	46 02	36.14
5/8	81.02	78.69	48 72	39.16
2/3	83 01	81.14	53 23	44 33
.7	84.42	82.9	56 88	48 54
.75	86.19	85 12	62 34	55.02
.8	87.61	86.91	67 83	61 69
7/8	89.08	88 81	76.1	72
.9	89.42	89.24	78.88	75.52

100.

Point of Cut-off.	Mean Steam Pressure.	Mean Air Pressure.	Terminal Steam Pressure.	Terminal Air Pressure.
.05	6 45	.69	*4.76*	*1.69*
1/16	10 24	4.11	*6.03*	*2.32*
.10	21 16	13.66	*9.95*	*4.49*
1/8	27.38	19.51	*12.61*	*6.15*
.15	33.1	25.03	.31	*7.95*
3/16	40.83	32 71	4.42	*10.89*
.20	43.21	35.14	5.79	*11.92*
.25	51.93	44 19	11 36	1.33
.30	59 5	53.32	17.	6.11
1/4	64.02	57.26	20 78	9 48
.35	66.14	59.62	22 69	11.23
3/8	69.14	62 98	25.56	13 89
.40	71.96	66.16	28 43	16.64
.45	77 05	72.02	34 23	22.36
.50	81.5	77 21	40 06	28 33
60	88.69	85.82	51.83	41.01
5/8	90 15	87 61	54.79	44.32
2/3	92 19	90.32	59.73	49.97
7/8	93 89	92 22	63.72	54 59
.75	95.83	94 66	69 7	61 69
.8	97.38	96 61	75.72	68.99
7/8	98.99	98.7	84 78	80 28
.9	99.36	99 17	87.82	87.82

Worm and Wheel.

The accompanying engraving represents the new pattern worm and wheel made by the Albro-Clem Elevator Co., Philadelphia, Pa. These worms and wheels are made by a new patented process, of any pitch, and wheel from 20" to 8 feet diameter, in single, double or triple threads.

It will be noticed that the face of the worm is curved to fit the radius of the wheel, and that the threads of the worm all point directly to the center of the worm wheel. This, it is said, gives about 75 per cent. more bearing surface than can be obtained with the ordinary worms and wheels. This should result in less friction, and call for less power to operate, and we believe this is found to be the case. These worms and wheels are made for any purposes required.

Gustavus C. Henning, consulting engineer, 726 Temple Court, 5 Beekman street, New York, recently met with a serious loss by fire in his office. Valuable books were destroyed, and a large number of papers and data, which it will be very difficult to replace. Mr. Henning's address will be the same as heretofore.

Mr. Edward Muller, designer of the "Muller" lathe, has accepted the superintendency of the Lodge & Davis Machine Tool Co., Cincinnati, O., taking the place formerly occupied by Mr. William Lodge with that company.

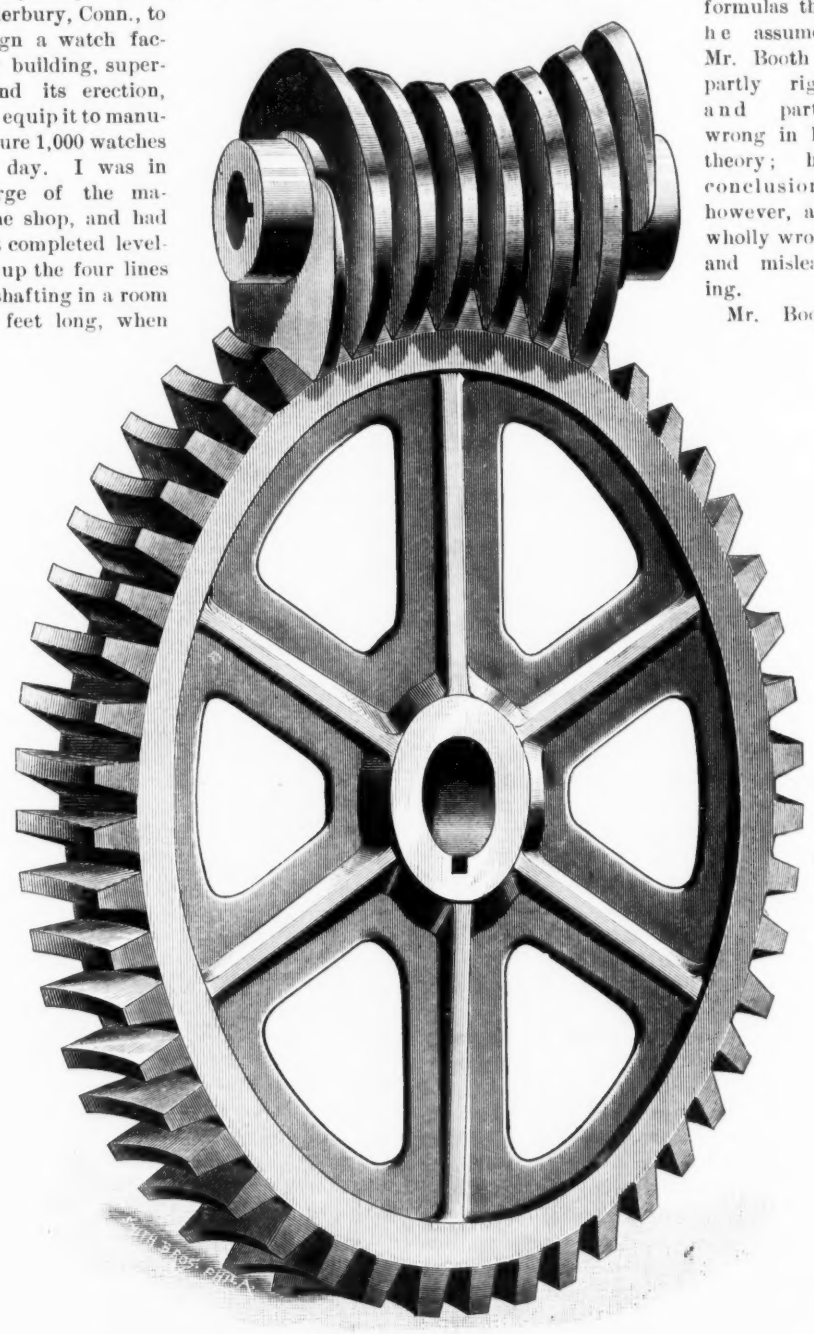
LETTERS FROM PRACTICAL MEN.

Sensitiveness of Vision.

Editor American Machinist:

Seeing the article illustrating the "Sensitiveness of Touch" of A. Webster, of the American Watch Tool Co., of Waltham, brings to mind his ability to discover errors in levels.

In the summer of 188— Mr. Webster was employed by the Waterbury Watch Co., of Waterbury, Conn., to design a watch factory building, superintend its erection, and equip it to manufacture 1,000 watches per day. I was in charge of the machine shop, and had just completed leveling up the four lines of shafting in a room 140 feet long, when



WORM AND WHEEL.

Mr. Webster made one of his periodical visits of inspection, and entering the room with Mr. N. Weeden, the acting superintendent, he stopped at the door a moment and looked down the length of the factory (140 feet), knit his brows, and looked keenly at the line of shafting, but made no comment upon it. He then walked down the room about ten feet with Mr. Weeden, and stopped and asked Mr. Weeden to return to the entrance again, and while standing there looking at the shafting I came up. After passing the compliments of the day, Mr. Webster asked me if the lines of shafting were level. I told him, "Yes, I leveled them all myself." Mr. Webster then said, "The north line seems to be out of level, there is something out of true there somewhere." I replied, "I know the shafting is level." Mr. Webster, after looking a little longer, said, "Well, something is out of true." I then told him that the shafting was level, but that the building on its north side was 3/8" out of level in the 140 feet, and I said, "You could not see that amount." Mr. Weeden joined in the conversation, and protested that it was impossible to see that amount of untruth. Mr. Webster quietly remarked, "I do not know that I can see it, but it is evident to you both that I saw something wrong, or I should not have come back to this door the second time, and made those pertinent inquiries, and the statement that 'something was out of true.'"

I think his sense of level is equal to his sense of touch. JOHN STEELE.

Theory of the Injector.

Editor American Machinist:

In your issue of March 2d, 1893, there is an article entitled "Waste Steam Injectors," by W. H. Booth. In this article Mr. Booth attempts to explain the theory of the injector and deduces results from two or three formulas that he assumes. Mr. Booth is partly right and partly wrong in his theory; his conclusions, however, are wholly wrong and misleading.

Mr. Booth is totally wrong when he says the velocity of flow of the steam is given by the equation

$$v = \sqrt{\frac{64.4\,(P-p)\,M}{d}},$$

(where the letters have the values assigned to them by him). This formula applies *only to liquids*, and does not apply at all to gases or vapors, although when the difference in pressures P and p is very small, as in the case of chimneys or ventilating shafts, it may be used without any appreciable error for gases. Again, this formula or any similar one assumes that all the energy lost by the outflowing liquid or gas has been used to give velocity to the liquid or gas flowing out.

Now all the energy the steam has it has in virtue of the heat in it, and when it is deprived of this heat in any way it cannot then do work. If, then, a pound of steam issues from the boiler, and all of the heat it contains is taken from it by condensing water, it cannot do the work necessary to force water into a boiler against pressure. That is self evident.

If, then, Mr. Booth supplies to his injector 7.6 pounds of cold water per pound of steam under the conditions stated by him, he will take all of the available energy from the steam, and he could not do a bit of work forcing water into his boiler.

The true theory of the injector is extremely simple and easily understood, as it is simply a question of the transfer and transformation of heat. Simple as it is, however, it is but little understood by writers, as few give correct equations for it.

I shall not attempt to discuss the equation of the action of the injector, but shall simply give it.

Let s be the number of pounds of steam used.

W the number of pounds of water lifted and forced into the boiler.

h the height in feet of a column of water, equivalent to the pressure in the boiler by the gauge.

h_o the height in feet the water is lifted to the injector.

t_1 the temperature of the water before it enters the injector.

t_2 the temperature of the water after leaving the injector.

H the total heat above 32° F. in foot-pounds in one pound of steam in the boiler.

L the lost work in friction and the equivalent lost work due to radiation and lost heat.

772 the mechanical equivalent of heat.

Then

$$s\,[H - 772\,(t_2 - 32)] = 772\,W\,(t_2 - t_1) + (W + s)\,h + W\,h_o + L.$$

If you assume $L = O$; also $h_o = O$, and $S = 1$. Then

$$H - 772\,(t_2 - 32) = 772\,W\,(t_2 - t_1) + (W + 1)\,h.$$

These equations explain, when discussed, everything there is to explain in the working of an injector. It would be rather out of place for me to discuss them in this letter, which probably is now longer than it ought to be. J. H. KINEALY.

Creaking Fly-wheels—Suction Pipes.

Editor American Machinist:

In your issue of March 15th, "X. Y." has an article on the interesting subject of creaking fly wheels. In his case it appears to be a case of being loose on the shaft, although blocking the wheel as he describes it would indicate that it was fairly tight. Creaking will be noticed many times in the wheel flanges where the arms are put in and held by bolts, and though the bolts are put in a driving fit and set up with tackle, on a heavy wheel there will be that disagreeable creaking. There is a chance for somebody to design a wheel that will entirely obviate this.

It is a question as to how much power would be required to turn a wheel on a shaft, that had been forced on. I once saw a 15-foot gear put on a shaft of some 16" diameter, with a screw-forcing machine that would equal probably some 40 tons pressure, possibly more. It was supposed when the shaft was first entered that the fit was simply snug, so it could be turned, and no attention was paid to having the keyways come together, but when it was on, the gear could not be moved so as to put in the key, and it ran for a number of days without the key, transmitting over 300 horse-power. It finally let go, and there was no trouble to turn it after that. The key was put in, and never gave any trouble.

A great many gears are put on with a loose fit, and hold all right with tapered keys.

Gears, however, usually run out of truth so much that the amount that they are thrown out of a true circle by tapered keys is neither noticed nor commented upon. With a fly-wheel to throw it out of true, even that small amount is a different thing. When a wheel creaks, if it is in the segments, the remedy for a short time is to tighten the bolts. The cause is uncertain. For a loose fit on the shaft the only sure remedy is a new wheel center, or a new shaft, with the probability that a new shaft will be the cheapest remedy.

Mr. Bullock's remedy for air in suction pipe is novel and valuable. I note, however, that he dug up, or dug down to a bell

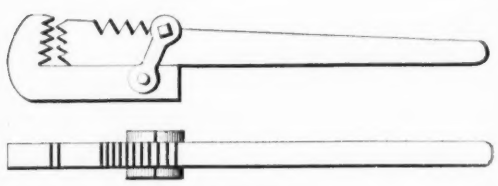
pipe and re-caulked it, a feat that has been duplicated in many experiences, but when a mill has been built over it, floors laid, and machinery set, it becomes a problem that requires an investigation of the finances of the establishment before it is undertaken.

A bell pipe is easily and quickly laid, and the latitude one has for crookedness are all in its favor, but when we take into account the temptations to profanity and other unseemly conduct, it weighs heavy on the other side.

One firm had been troubled so much with a leaky suction pipe that they put in a sewer pipe from the river to a well in the yard near the pumps, so that the water would flow by gravity.

The distance is towards 2,000 feet, and some of the depth is 15 feet. It has been a success from the start, and will amply repay them.

Another measure that is resorted to at times is to put the pump at the source of supply, and force the water to the mill or point of distribution. W. E. Crane.



Pipe Wrench.

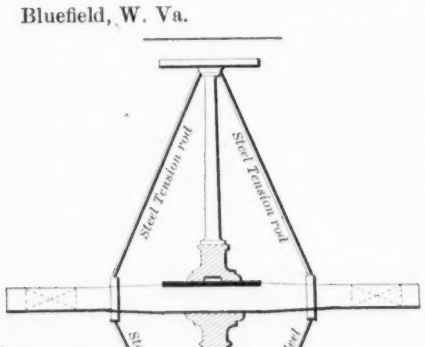
Editor American Machinist:

The pipe wrench of which I have given a sketch may be very useful to some of the boys who are in the habit of using such tools; they will find that it can be made very cheaply and easily by any machinist; the parts are very few and simple.

The handle may be withdrawn when not in use, no spring to get out of order, will release from pipe or iron without spring; I have made this wrench and used it on pipes and round iron, also nuts, and it can be used on nuts for bolts where a monkey-wrench will fail. I find it is a very useful tool, and the idea is worth having for nothing.

Jeremiah Davies.

Bluefield, W. Va.



Strengthening a Shaft.

Editor American Machinist:

In your issue of March 16th, X. Y. describes the method adopted of reinforcing the hub of a fly-wheel, evidently in the hope of avoiding an accident from a broken or weak shaft—the weight is stated as nearly 30,000 pounds (15 tons). I would suggest that that amount of metal distributed, as shown in the accompanying sketch, would afford a great deal more assistance to the center of the shaft, and to the whole shaft considered as a beam, and could have been easily applied.

I hope no one will understand me as favoring patching in such cases, in preference to finding the trouble and properly curing it, however difficult. Fred. W. Salmon.

A New Way of Selling Machinery.

Editor American Machinist:

We have our attention called to an editorial in your issue of the 23d, regarding a new way of selling machinery.

It is possible we should not have adopted this method if we could have sold our machinery any other way. However, when the writer started to manufacture the trimmer, in 1885, he found it almost impossible to convince people it was a tool that would be any service to them. He sold a few machines to such concerns as Brown & Sharpe, Yale & Towne Mfg. Co., and other large manufacturers, by sending them machines for inspection. The majority of people took the ground that they had never used a tool of this character, and if both they and their father and their grandfather got along without it, they certainly could, and in order to get them to give the matter any consideration whatever, it became necessary to have the salesman take a practical working machine with him to demonstrate what it would do. By this means we have been enabled to dispose of about seven thousand of them. They have not only gone into all parts of the United States, but also to Australia, South Africa, India, China, Japan and all parts of Europe. We found that even in the old manufacturing districts in the Old World, where they made machinery before we began to use it, they had no tools for accomplishing the work that our trimmer performs, and the advent of our machine among them has created quite a sensation.

Please accept our apology for burdening you with this lengthy communication, but we felt as though we must give some explanation for our method of procedure, adopted on account of the necessity of the case, owing to our having entered an entirely new and, heretofore, unworked field, in which we not only had to prove to our customer that we had a new article, but also that there was a demand for a tool of this kind in his own establishment which he had not before discovered.

The Fox Machine Company,
Per W. R. Fox, President.

Equation to the Curve for Techs.

Editor American Machinist:

Hoping not to be considered an intruder, as I am no technical graduate, I would like to say a few words in regard to the curve produced by Mr. Allen in the American Machinist of March 9.

If the vertex of the curve be taken for the pole, and the fixed line on which the generating circle rolls be made the polar axis, and letting a represent the radius of generating circle, r radius vector, and Θ the variable angle, then the polar equation of this curve will be $r = a$ (cosec. $\Theta - 1$) The equation $r = b$ cosec. $\Theta + a$ will be recognized as the polar equation of the conchoid, when the fixed point or pivot is taken for the pole, and the polar axis parallel to the fixed line; a represents the constant portion of the revolving line, b the perpendicular distance from the pivot to the fixed line, and r and Θ polar co-ordinates. When a is numerically equal to b, and a negative, this equation becomes $r = a$ (cosec. $\Theta - 1$), which is the equation of Mr. Allen's curve. From an inspection of the latter it also appears that the radius of the generating circle sustains the same relation to the radius vector and the locus of the center of generating circle, as a does to the radius vector and the fixed line in the conchoid referred to above.

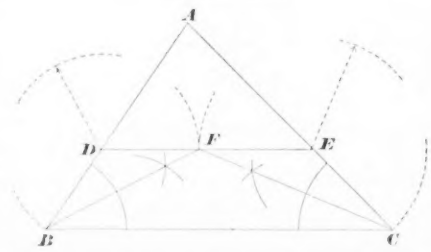
I therefore think that the curve shown by Mr. Allen is that branch of the conchoid which is generated when a is numerically equal to b, and a negative; although the former is produced from a different, and, as I believe also, new definition. If the straight lines drawn from vertex of curve to center of generating circle be produced indefinitely beyond the center, then their new intersections with the circle will be points in that branch of the conchoid which is traced when a is numerically equal to b and both positive. Herman Oberg.

Those Sibley College Forgings.

Editor American Machinist:

This is not a miracle. The same thing could be accomplished in any machine shop if they were working for the apprentice instead of the apprentice working for the shop. Given a known grade of crescent steel, a scale for tempering, and a young man with rather more interest in his business than the average apprentice has; divide the instruction into 50 days or 25, according to the capacity and natural aptitude of the pupil (the shapes are very simple), and it would be very strange if an instructor could not get them done in this time.

Thomas C. Lace.



Another Solution of Cutting a Triangle.

Editor American Machinist:

Amongst the answers to correspondents in your issue of March 16th (No. 118) is a very interesting construction of the problem:

To draw a line D E parallel to a side of a triangle A B C whose length will be equal to the sum of the segments B D and C E.

Your correspondent may like to see another solution.

Let $A\ B\ C$ be the given triangle. Bisect the angle B by the line $B\ F$; also bisect the angle C by the line $C\ F$, intersecting the former at the point F. Through F draw $D\ E$ parallel to $B\ C$. $D\ E$ is the required line.

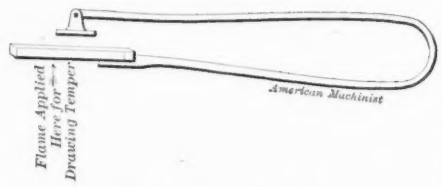
Proof.—Since $D\ E$ is parallel to $B\ C$, the alternate angles $D\ F\ B$ and $F\ B\ C$ are equal; but by construction the angle $F\ B\ C = D\ B\ F$; $\therefore$ the angle $D\ F\ B = D\ B\ F$. Therefore the triangle $D\ B\ F$ is isosceles. Therefore $D\ B = D\ F$.

Similarly we may show that the triangle $E\ F\ C$ is isosceles. Therefore $E\ C = E\ F$.

Therefore $D\ B + E\ C = D\ F + E\ F = D\ E$. Frederic R. Honey.

New Haven.

[We have received a similar solution from T. W. Marshall, Purdue University, Lafayette, Indiana.—Ed.]

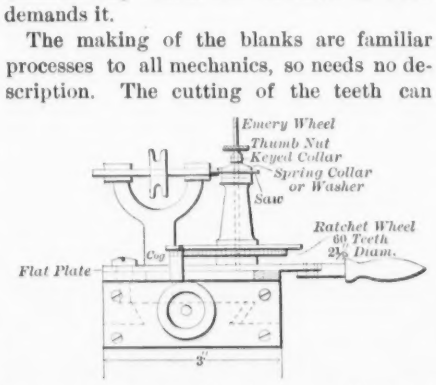


Metal Slitting Saws.

Editor American Machinist:

I wonder how many readers of this paper know where to get or how to make a good metal slitting saw? There may be quite a number who can make them, but if there is one who knows where to buy them, he knows a good deal more in that direction than I do. What I mean by a good saw is one that has some *life* to it, and that will not lose its clearance, stick in spline and break within ten minutes after starting in. To make them *right* is a very easy and simple matter when you are onto it. This article is, of course, intended for the benefit of those who are not, and there are many such. This method will apply only to saws .025 thick and less. I find a safe diameter for a saw .025 thickness is $1\frac{3}{4}''$; .020, $1\frac{5}{8}''$; .015, $1\frac{1}{2}''$, and .010, $1\frac{3}{8}''$. These diameters can be exceeded but it increases risk of breakage in use and warping in hardening, and should be done only when the character of work demands it.

The making of the blanks are familiar processes to all mechanics, so needs no description. The cutting of the teeth can



be done on an arbor ($\frac{3}{8}''$ is an excellent size hole for saws mentioned) from 100 to 150 at once; 60 teeth is about the right number, and be sure the cutter used for milling teeth is rounded on extreme points of teeth so as to leave a small fillet at the bottom of each tooth, which fillet must always be preserved in subsequent grindings, a fact for which you should be devoutly thankful, as any one knows who has ever tried to keep a *sharp* corner on an emery wheel. The fillet is to reduce breakage.

Right here I would state that a saw is never much good until it is ground, any more than a cutter or any other tool.

When the blanks are finished get an old surface plate or any big chunk of iron with a smooth true plane surface and lay it as close to your fire as possible; then a good heavy smoothing iron, which is as good a thing as I know of. Make the surface true if it isn't; then heat a slab of iron, lay on your saws any where from one to a thousand, or more, as fast as you need them; get a helper to handle the flat iron. Success now only depends upon the two people engaged. A sudden transfer of heated saw to cold plate and a quick pressure and twist of flat iron, and if you use good steel you will have as pretty, true and hard a saw as you can saw with. Then polish one side sufficiently to see color to draw down; polish convex side if there is one, and there sometimes is; place on the flat circular disk shown in sketch, clamp firmly together, hold over a Bunsen burner and draw to a *decided* straw, and remember that a saw will not do any more work when drawn to a purple or blue, like plenty of the saws of commerce are, than any other metal cutting tool. A saw made in this manner does not need any clearance; it can be of the same thickness throughout and will work well.

Another important thing is use them on a *true, hard* arbor. Punch the blanks .004 small, then ream to size; run reamer in drill press. Hold blanks in hands. To get service from a saw every tooth must do its share of the work, and it cannot do this unless the arbor is true, fits the saws, the saws round, and the hole central.

The arbor should have a keyseat in it $\frac{1}{16}''$ wide and $\frac{3}{64}''$ deep to carry two hardened and ground collars, both keyed; or to make it clearer, a hole drilled through the side of each collar $\frac{1}{8}''$ diameter, and a hardened pin with the end flatted to fit keyway and driven in collar neatly. The object of keys is to prevent stress on saw when working and tightening itself any tighter than when first put on, which it will do if it runs the right way. The saw can be tightened between the collars tight enough to do its maximum of work, and when this is exceeded it will slip between collars; otherwise it would break.

The lower sketch is of a grinder, a very good and valuable tool if properly made. Without it or something similar *good saws* and work is impossible.

H. H. Hardinge.

Some Additions to a Testing Machine.

Editor American Machinist:

A year ago I made the following improvements in the Riehle torsional testing machine in use at the Imperial Arsenal, St. Petersburg, Russia.

The big and heavy clamp nuts of the machine which gave various inconveniences in use were removed and replaced by the contrivance shown in the photograph. Two dogs a (page 7) are fastened to the test bar by screws b, whilst the bar is held in the clutches of the machine and prevented from turning by means of the screws c. Theoretically this arrangement is inferior to the nuts, but in practice it is better. The nuts are objectionable because one of them must hang on the test bar whilst the other is being adjusted, and thin bars suffer. Having no place for the fingers the clutches cannot be regulated; there is not sufficient room on short bars to place the two nuts preparatory to adjusting them.

I have also constructed and applied to the machine a cheap diagram apparatus for recording the strains and angles of torsion. For this purpose I took a mechanism d out of a carcel oil lamp, and fixed it as shown on the annexed photograph. Its movement is fed by a weight hanging to a cord e which passes over the wheel o. The mechanism d is set in motion when its governor f is released from the restraint of a small brass plate g which is screwed to the graduated

lever of the machine. The sliding weight *i* (with place *h* for an additional weight) is suspended from rollers moved by the string *e* when the mechanism is in motion, which takes place when the lever is out of equilibrium. On slowly turning the handle (crank) *v* which moves the wheel *k* and twists the test bar, it can be seen how the sliding weight *i* follows closely the increasing strains.

I filed off the slight projection on the middle of the lever arm and continued the graduations so that no additional weight is required to be suspended from the loop *l* in conducting tests.

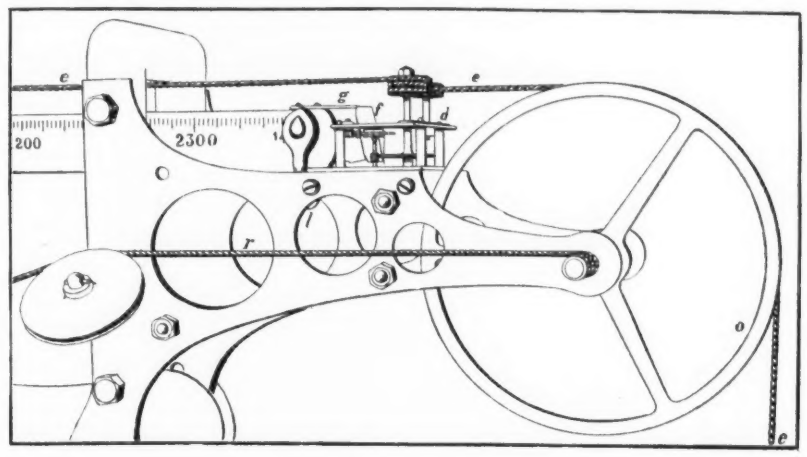
The weak part of the machine, namely, the cast-iron muffs, on which the large nuts could not be screwed, and which could easily split without support, have been strengthened by the iron rings *m* and *n*.

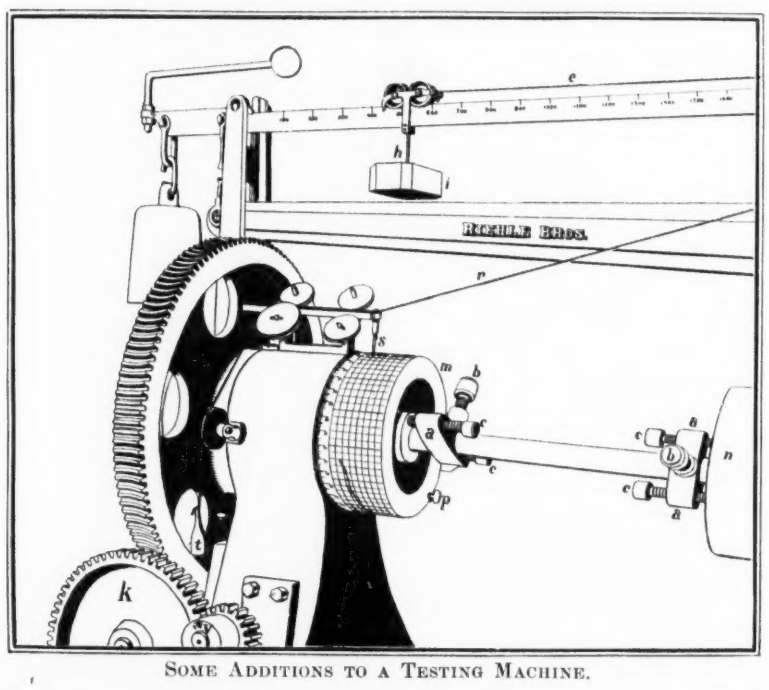
A sheet of graduated paper is rolled upon *m* and held by a fork and screw *p*.

The end of the shaft of the wheel *o* is cut like a screw, and a cord *r* winds itself upon it when the sliding weight is in motion and pulls the pen *s*, which traces a line on the graduated paper and indicates the corresponding strains and angles of torsion. The cord *r* is kept taut by the small weight *t*.

Prince Andrew Gagarine.

24 Boulevard Victor Hugo, Chatellerault (Vienne), France.





Some Additions to a Testing Machine.

That Squeaking Fly-wheel.

Editor American Machinist:

I would suggest that "X. Y.'s" crank-shaft squeak may be occasioned by the wheel being a little out of balance, which would produce one strain while the belt or ropes were making another, which might easily work the segment joints or spokes enough to produce a squeak. Such a noise would be hard to locate, and he may be looking in the wrong place when he locates it in the shaft instead of the rim.

Erick Butler.

Profit Sharing.

Editor American Machinist:

In the issue of February 23d I read the article "Premiums for Continuous Service." The action of the American Watch Tool Co. should be appreciated by all machinists and similar action encouraged among employers, as it certainly has a good effect, but the action of the above company is not to be compared with the system adopted four years ago by the Ingersoll-Sergeant Drill Co., one of the largest machine shops in New York City. The system is in fact very little known of by machinists of this locality. It is that of profit sharing among its employes. In February of each year for the last four years they have declared a dividend to each employe who has been in their employ for one year, ranging from 4½ to 5 per cent. on their earnings for the year (employes' earnings). So you see that a man earning $3 a day received a dividend of $40 to $45, which is equal to about 14 days wages for continuous service for one year. As there are about 250 employed by this firm the amount paid in this way is quite a sum, and surely a more contented or faithful lot of employes could not be found, and when you hear of any discontent among the men of this shop that will be a phenomenon worth going miles to see. J. E. L.,

One of the Employes.

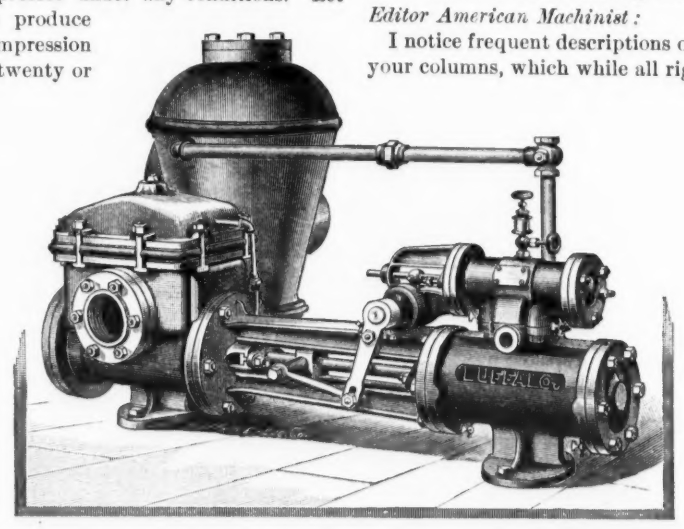
Those Air Compressor Diagrams.

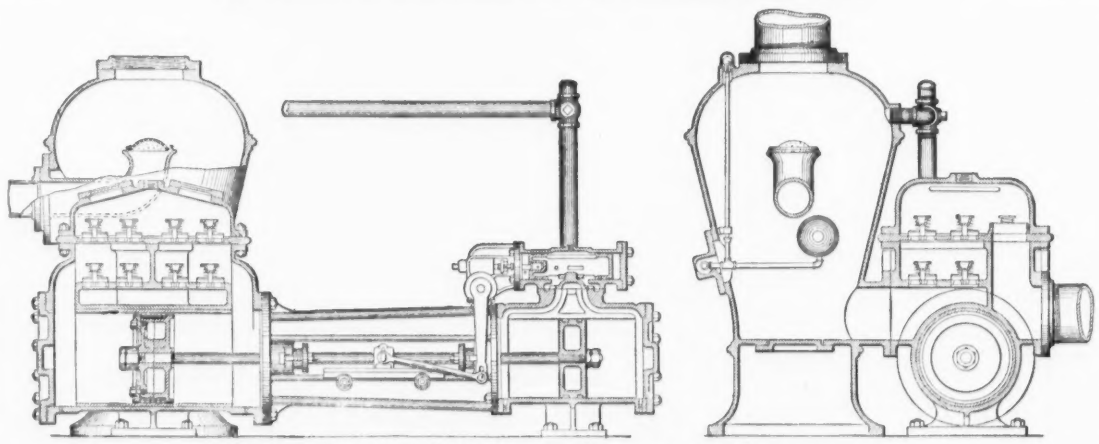
Editor American Machinist:

If anybody wants to get along happily with me they will please not call me Professor. It is hard enough sailing without having to carry false colors. I do believe in displaying my true colors, and I think that the name of every craft on the high seas should be easily discernible.

The indicator cards contributed by "B.," in your issue of April 6, seem to challenge some remark from me, and I would be happy to rise up and try to say something about them, only I would like first to have a little more of the necessary data in the case. I would like to know the dimensions of the cylinders and the number of revolutions per minute, and I would especially like to know the kind of air that was used. I can't get hold of any air in this part of the world that would give such a compression line in any compressor under any conditions. Let any one produce that compression line for twenty or thirty pounds higher, and see "where he will be at."

The air also shows its peculiarity in the re-expansion line. With air that has been properly trained, the pressure of what remains in the clearance spaces begins to fall as soon as the piston begins to return. The drop should be a lively drop from the top and not a dull thud from 8 or 10 pounds down to atmosphere. Frank Richards.





The "Buffalo" Independent Air-pump and Condenser.

Planer Tool Lifting Device.

Editor American Machinist:

I notice frequent descriptions of planers in your columns, which while all right in other purpose. Of course on a small planer the want would not be felt so much as on a large one. The planer that I am now on is 17 feet long and very often I use the full length of the table, which means 17 feet of friction that the tool has to stand, and as it is a well-established fact that friction produces heat, we must know that when the tool emerges from the cut that it is warm and has a tendency to draw the temper out of the tool. Now if there was some device for raising the tool while the planer was on the return stroke, the friction that is caused by the tool trailing over the cut would be averted and also give the tool a chance to cool off, and as I am in a position that I cannot use the old-fashioned way, that is with the chain running through or over a roller overhead, I have asked for some device.

Thos. Duncan.

Peterboro, Ontario.

[In our issue of November 3, 1888, will be found an illustration of a device which can be easily made and applied and is applicable to almost any planer tool.—Ed.]

The "Buffalo" Independent Air-pump and Condenser.

The engravings with this are of the "Buffalo" single-cylinder independent air-pump and jet condenser, and show the construction quite completely. It is representative of a type of condensing apparatus that has come largely into use during the past ten or fifteen years. Having no connection with the engine, it can easily be applied to non-condensing engines already in use, and to engines in which the speed is too high for the ordinary connection from the shaft to pump. It can also be used in connection with two or more engines, either or all of which may be stopped without interfering with the action of the condenser.

When used on vessels, the pump may be operated, very effectively, as a bilge pump. It is also used for vacuum pans, and in all places where an air-pump and condenser are required.

The condenser is provided with an automatic attachment, so that if from any cause the pump fails to act the vacuum is destroyed, the inflow of injection water stopped and the flooding of the engine cylinder avoided.

The lining of pump cylinder, the pump piston, and valve seats are made of gun metal composition, and piston rods and valve bolts of Tobin bronze.

The manufacturers are the Buffalo Steam Pump Company, Buffalo, N. Y.

The Colombian government has extended for a period of twenty months the concession to the Panama Canal Company. It is hoped that in this time a new company can be organized.

Balloon Signaling by Night.

Mr. Baden-Powell, of the Scots Guards, has devised an ingenious method of signaling by night with the aid of a paper fire balloon of six or eight feet diameter. When it is desired to send a message, some beads made of a brilliant, quick-burning composition are strung on a piece of quick-match, leaving intervals and using large and small beads to make the corresponding flashes.

The balloon is inflated by burning spirit or even straw or wood. The message is then suspended below it, a time fuse attached, and the balloon being sent up, the message is flashed forth. The apparatus is described as very portable; one man can easily carry it, and with it not only can one preconcerted message be flashed, but a few words can be sent up at one time, and those can be answered from a similar balloon from another part, upon which other balloons can be employed to continue the signaling.—London *Daily News*.

AMERICAN MACHINIST

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J. G. A. Meyer, } Associates.
Fred J. Miller, }

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Line Officers of the Navy the Most Skilled Engineers.

The correspondent of the New York *Times* who signs himself "Fair Play" still continues his apparently interminable effort to prove that the engineers of the navy are the natural enemies of the machinists, while the line officers lie awake nights worrying about the forlorn situation of the aforesaid machinists, and trying to devise schemes by which they can be relieved of the oppression and contumely with which they are treated by the engineers. The last ten or fifteen articles have, however, been nothing more than the most remarkable series of repetitions of ideas and words which we happen to have ever noticed; scarcely a single new idea or word appearing in them until the latest effort comes out with something new and very striking. This is nothing less than the assertion that line officers, by reason of their training at Annapolis, and their experience with guns and gun carriages, must necessarily know more about machinery than engineers or machinists can ever hope to know. Hear him.

The difficulties and the skill involved in the design and management of guns and their mechanical carriages, and the danger incident to their control under pressures twenty times as great as those with which an engineer has to deal, are greater than the difficulties, the skill, or the danger involved in the design or management of a steam engine. The line officer has a complete knowledge of all the mathematical and mechanical principles involved in the design and management of machinery.

* * * * * * *

No engineer in the navy is engaged in work with machinery and metals that requires so much skill and knowledge of mechanical science as the work now performed by line officers at the naval proving grounds in the tests of guns, gun carriages, and armor.

The charge, therefore, that line officers are ignorant of machinery or of the principles involved in its design and management is false. They are designing and controlling "machines" far more complicated and twenty times more dangerous than the steam engine. The latter is a simple and harmless "machine" compared to the thirteen-inch gun, and the appliances for controlling it under a powder pressure of 35,000 pounds per square inch. In short, the line officer is "ignorant" of none of the "machines" on board ship, and he knows far more than does the engineer regarding many of the "machines" and the functions they perform in battle. The steam engine is the simplest and least dangerous of all these machines, and its care and management requires less education and less skill, as shown by the fact that men of no scientific training are employed to run the engines of great Atlantic liners.

The writer of that is, of course, a line officer. No one else could possibly know so much about what they know nor of the relative amounts of stored energy in a marine boiler on the one hand and a 13-inch gun on the other. His charmingly ingenuous inference that because the engineers of the trans Atlantic liners have not been educated at Annapolis they can have had no scientific training, can know very little, and that therefore the management of marine engines and boilers requires very little skill or scientific knowledge, will be appreciated for its unconscious humor, if for nothing else.

Railroad Rates During the Fair.

There appears, so far, no very evident intention on the part of railroads to make any striking concessions in the way of passenger rates to and from Chicago during the Fair. Concessions will undoubtedly be made, but hardly to the extent that has been anticipated. It is to be expected that railroad companies will operate their roads in the way to make the most of their opportunities; in other words, they will not reduce their rates unless by so doing they can make more money. It would be satisfactory in a good many ways if the fare could be very materially reduced through the summer and early fall. It would enable a great many people of moderate means to visit the great Exposition who cannot afford to pay full, or nearly full rates. But the same can be said of the cost of living at Chicago. The increase in this will keep many away.

There is considerable abuse of the great trunk lines because of their evident intention to make the most money possible during Fair time. But after all such abuse is no more than the abusing of human nature in general. Railroad corporations are not charitable institutions. They exist for the purpose of making money. When business is dull they may, like other corporations, or like individuals, lose money, or fail to make any; when business is good, they very naturally try to reverse this. Railroad corporations should be judged no differently for doing this than other corporations or than individuals.

If the railroads centering in Chicago find their capacities overtaxed, as it is evidently expected they will, there will be no startling reduction in the price of tickets. If on the other hand, their facilities for transporting passengers is largely in excess of the demand, rates will be lowered, not from charitable or patriotic motives, but for the purpose of making money. What else can be expected? It will be a case of demand and supply, just as hotel charges, and, in fact, everything connected with the whole matter of paying a visit to the Fair will be. We can only hope that things will so shape themselves that all who wish can see something of the great show.

Compound Locomotive Tests.

At the Saratoga meeting of master mechanics last year, it will be remembered that there was a remarkably wide divergence in the opinions expressed by members as to the economy of compound locomotives. The percentage of saving claimed by some was suspiciously high, while others claimed that the saving was negative. From that time on opinion on this subject has been very decidedly divided. Not long since the C., B. & Q. railway followed up what had been done in the way of settling the rather vexed question by a test of two compound and three simple locomotives. The result was that at speeds less than thirty miles per hour the compounds gave a little the best results, but at higher speeds the simple engines had decidedly the advantage. Altogether, judged by the C., B. & Q tests, compounding received a set-back. It is not to be supposed, however, that this test will be taken as settling the question. The advocates of compounding have already found plenty of reasons for the results being as they were. There may be reason in what they say, but excuses are not what is wanted. The conditions of a test of this kind should be such that there is no room for excuses. And this will have to be the case before anything is settled. Probably the test made has not changed the opinion of a single individual, not even of the officers of the road named. It has served to strengthen the opinions of those who were opposed to compounding, but has scarcely affected in any way those who advocate it. It was in no way conclusive.

A contemporary is publishing a very interesting series of articles on the life and work of Edison, and a picture presented with the last installment is a very good example of how far the average artist can go astray on technical subjects when working on his imagination and not "on the spot." The subject is the announcement by Edison to his workmen on one occasion that he had locked the doors and that they would have to remain there until certain badly needed work was completed. Every one who has ever been in a shop knows about how such a declaration would be made by an employer, and that it was nothing more than a facetious way of informing them that it was supremely important that the work should be completed in time; but the artist has Edison standing before the assembled men apparently as though making them a Fourth of July speech, while the background is made up from the view of the Niles boring and turning-mills at Watervliet Arsenal, which was published in our issue of December 10, 1891, the beauty of this being that the tools for making heavy guns, six 5-foot boring and turning-mills, are shown as the equipment of a shop making the lightest and most delicate electrical machinery, where if a 10" hand lathe is used it is probably the heaviest tool in the place.

Literary Notes.

SLIDE VALVE DIAGRAMS. A French method for constructing slide valve diagrams. By Lloyd Bankson, B. S., Assistant Naval Constructor, U. S. Navy; Associate Member of the Institution of Naval Architects, England.

This little book is one of Van Nostrand's science series. It gives a simple and rational method, as is used in the French Naval Service, for constructing the valve diagrams of ordinary slide valve gears in which the valve is moved by an eccentric. From these diagrams the action of the valve can readily be traced throughout the whole revolution of the crank with great accuracy, as the angularity of both the eccentric rod and connecting rod is taken into account. The author does not consider the subject of valve design. But for studying the theory of the slide valve from the simple locomotive slide to the Meyer cut-off, together with the action of the link, the methods here presented seem to be remarkably well adapted; the effect of change of lap, or a change in the angular advance of the eccentric can easily be traced, and no one should have any difficulty in comprehending and applying the methods. The whole subject is very clearly stated in the 29 pages of reading matter and 8 folding pages of good illustrations. The book is published by D. Van Nostrand Company, 23 Murray and 27 Warren streets, New York. Price, 50 cents.

The bound volume of *The Locomotive* for 1892, published by the Hartford Steam Boiler Inspection and Insurance Co., Hartford, Conn., is got up in the usual neat, bright and attractive style, and in its fund of information relating to boiler management, construction, and kindred subjects, and in the many interesting items relating to other matters which it contains, is in nowise behind its predecessors. Its complete index makes it a handy book for reference. Copies of the volume can be obtained at $1 each.

Questions and Answers.

Questions of general interest relating to subjects discussed in our columns will receive attention in this department. The writer's name and address should always accompany the question. Neither correct initials nor location will be published when there is a request to that effect. If questions are enclosed with a business communication, they should be written on a separate sheet.

(168) C. A. B., Kansas City, Mo., writes: Kindly advise me as to what is the proper speed of a cold saw for sawing rail, channel and other shapes of steel. We have heavy saws and are troubled with the failure of saws, and I thought perhaps you could help me. *A.*—The velocity at the circumference is about 15,000 feet per minute. The saw consists of a plain soft steel or iron disk without teeth, about 42 inches diameter and $\frac{5}{16}$ inch thick.

(169) H. F. P., Malone, N. Y., writes: Kindly inform me where I can purchase a book relating to traveling cranes, derricks, etc., a work that will post me on the gearing, etc., for lifting given loads. *A.*—There are a number of books published on this subject, but we hardly know which one will suit you. Send to any dealer in scientific works for catalogues; the addresses of some of these dealers are given in our advertising columns. You may need more than one book.

(170) A. E. C., Brooklyn, N. Y., asks: Can water be compressed under any circumstances? *A.*—Practically we may treat water as incompressible, although experiments show it to be compressible to a slight extent. Thus, a cubic inch of water under a pressure of 15 pounds on each of its six faces loses only fifty-millionths of its original volume, while remaining at the same temperature; if the temperature be sufficiently raised, however, its bulk will remain unchanged, provided the initial temperature is over 40 degrees Fahr.

(171) J. H. T., Birmingham, Ala., writes: I should be pleased if you will refer me to

any back numbers of the AMERICAN MACHINIST during the last few years containing particulars as to the best methods of getting out costs, charging, etc., in a machine shop. I think if a correspondence could be opened in your columns on this subject, it might prove very interesting to a great body of your readers. *A.*—This subject has been discussed in our columns; see our issues of Feb. 28, March 14, August 22, 1889; July 10, 17, 31, 1890, and June 9, 1892.

(172) C. H., Portland, Oregon, writes: In a back number (February 12, 1891) "Novice" asks if he can cut left-handed threads by using two intermediates. I wish to know why two intermediates are needed. On my lathe I cut left-hand threads with the same gears as are used for right hand. *A.*—You are mistaken. Your lathe is probably so made that it is not necessary to put an extra intermediate upon the swing plate, but an equivalent thing is done when you reverse the stud by the movement of a lever or other device supplied for that purpose. The movement of this lever or handle simply puts into action the extra intermediate gear.

(173) F. W. R., —— writes: Will you inform me if there is any mathematical formula by which the foot-stock of a lathe can be set over to produce a given taper? *A.*—This is an ever-recurring question and we have answered it several times. Practically the distance cannot be computed accurately, for the reason that the proper allowance for the distance the centers enter the work cannot be made. An approximation can be arrived at as follows: Set over a distance in inches equal to half the taper per inch multiplied by the total length of the piece in inches less the estimated distance which the centers enter the work. Set the tool level with the center.

(174) B. & H., ——, ask: What is the required time and what are the terms on which a young man who has served an apprenticeship in an ordinary machine shop can enter a shop where stationary or marine engines are made, and learn the business? *A.*—It depends upon the man and the shop. Stationary and marine engine shops are usually ordinary machine shops also, and some of them are very ordinary indeed. In most cases a smart young man who has served an apprenticeship on other good work can get along all right on engines. When he doubts this, he can usually arrange to work a year or so under instructions at reduced rates, the amount paid him depending upon circumstances.

(175) R. S. B., New Orleans, La., writes; What is the comparative cost of a 100 horse-power Corliss engine, and the ordinary slide-valve engine? And what is the relative consumption of steam per horse-power per hour? How would a 50 horse-power slide-valve engine and one of the same power in the automatic type compare in price and consumption of steam? *A.*—We are in no way interested in the sale of engines, and therefore have taken no pains to keep informed of the best terms manufacturers are offering to purchasers. The best way to obtain reliable information is to write to manufacturers for prices and guarantee of engine performances, which will enable you to make your own comparisons.

(176) J. D., Bluefield, W. Va., writes: I have to repair a certain locomotive fire-box by putting on the inside a patch with patch bolts; the patch is about two feet by three feet, of steel. Between the fire-box sheet and the patch I propose to put a piece of $\frac{1}{16}$ inch copper. Now A. claims that the copper will cause the patch to burn away sooner than without the copper; B. claims that the copper will burn first. We leave the question whether the steel or copper will burn first for you to settle. *A.*—Practically, there will be no difference between the wear of the copper and steel as you propose to use them. If the patch is in a position which will not prevent the use of calking tools, a good boilermaker would use no copper for making a tight joint, as the difference in expansion between the steel and copper may cause trouble.

(177) H. S., Provo City, Utah, writes: In your issue of February 23, I noticed an answer to my question (81) which is very unsatisfactory because you presumed the engine to be in bad condition. Now I should be pleased if you would answer my former question with the understanding that the engine referred to is in first-class condition. I have been told to put on a larger pulley on the engine so as to reduce its speed about one half, and thereby I would save fuel; but I do not wish to go to the expense before having your opinion. I know the engine is too large for the work it has to do; but expect to utilize its full power in the near future. *A.*—Putting a larger wheel on the engine so as to reduce its speed will save fuel; in making the change the weight of fly-wheel should be taken into consideration, which may be too light for as great a reduction as you propose; in that case you will need an extra heavy pulley. We are still inclined to believe that the engine is not in as good a working condition as you seem to think it is; hence it will be to your advantage to have indicator cards taken, which will show any internal defects, and may lead to a further saving of fuel.

(178) G. W. C., New York, writes: In Appleton's Cyclopedia of Applied Mechanics, under the head of Proportions of Parts of Engines, page 639, I find the following formula for the thickness of cylinders,

$$t = 0.0001 \times D \times p + 0.15 \times \sqrt{D},$$

in which D is the diameter of cylinder in inches; p, the boiler pressure observed, and is apparently added to 15 for absolute pressure; t, the thickness of cylinder in inches. On page 641 there is an example given as follows: What is the thickness of cylinder 6 inches diameter, boiler pressure 105 pounds per square inch? The answer is 0.439, or about $\frac{7}{16}$ inch. I cannot make it come out correct, kindly explain why. *A.*—The answer is correct. In this example the boiler pressure is given, and this added to 15 pounds gives the absolute pressure, hence $p = 120$ pounds. Now substituting for the symbols their values we have

$$\begin{aligned} t &= 0.0001 \times 6 \times 120 + 0.15 \times \sqrt{6} \\ &= 0.072 + 0.15 \times 2.449 \\ &= 0.072 + 0.367 = 0.439. \end{aligned}$$

(179) T. W. R, Prince's Bay, N. Y., asks: Can the principle of the wedge or any other mechanical power be applied in computing the elements of cutting tools as used in lathes, planers, shapers, milling machines, etc.? If the answer is in the affirmative, how can I compute the ratio of the velocity of the cutting tool to that of the resistance; that is, the metal to be cut in accordance with the principle of some mechanical power? *A.*—We presume you wish to know the speeds of various tools for cutting metal The speeds will vary with the depth and breadth of the chip, with the shape of the tool, and with the nature and density of the metal operated upon. No simple rule for determining these speeds, applicable to all cases, can be given; it all depends on individual experience and judgment, guided more or less by the results of experimenters. In regard to the mechanical powers to which you refer in the above and other questions too indefinite to repeat here, it may be said that the principles involved, like all the principles in mechanics, that is, the science which treats of the action of forces on bodies, play a very important part in the solution of many practical problems, and if these are understood there will be no difficulty in computing the velocity ratio, provided it is known what velocity ratio is required. Your questions are so indefinite that we can answer only in a general way as above.

(180) C. C., Cleveland, O., writes: Kindly enlighten me on one point of the valve motion, of which I am ignorant. We will suppose that the link motion of a valve is correct, could it be so arranged by setting the saddle pin out of center as to cause the steam to be cut off at the same point of the stroke for both ends of the cylinder? If so, would there be a perfect exhaust, or in other words, would the valves be square? *A.*—The saddle pin can and should be moved out of the center line of the link, towards the eccentrics, so that the steam will be cut off at equal distances from both ends of the cylinder. Under these conditions the exhaust will be practically perfect, or as the engineers would say, the valves will be square. Of course we assume here that the lifting shaft has been placed in the correct position, otherwise satisfactory results will not be obtained by simply moving the saddle pin out of the center of the link. 2. Again, if we divide the eccentric rods by the cut-off, say at 9 inches of the stroke of piston, would the point of release occur at the same point from each end of cylinder, and therefore have square valves? *A.*—The cut off should in no wise influence the setting of the eccentric rods; these, in connection with the eccentrics, are set simply to give the valve the correct relative motion to that of the piston. Any attempt to regulate the cut off by the length of the eccentric rods will result in a distorted valve motion.

(181) A. B. B., Cleveland, O., asks: What are the decimal equivalents for the numbers that stand for the various sizes of machine screws? I have tried several standard gauges and I found that gauges having the same numbers, but with different numbers of threads per inch, had a variation of several thousandths in size. How would you proceed to find the sizes? Can you tell how they originated? Is there a common factor that can be used to get the proper size drill for different taps? What variation would you allow for a good thread in cast-iron? *A.*—Machine screws of the same number are intended to be of the same size, provided, always, that the same gauge is used, and there should be no variation on account of different numbers of threads per inch. In our issue of August 18, 1888, is a table giving the equivalent sizes for all numbers of screws by the gauge generally used. We do not care to reprint the table, but the formula is $d = (N + 2 \times .01316) + .03152$, in which d equals the diameter of wire or screw, and N the gauge number. For instance, taking number 8 the formula becomes $d = (8 + 2 \times .01316) + .03152$, which gives .16312″ as the size of wire. The size at bottom of thread is found by the formula

$$d = D - \frac{1.733}{n},$$

where d = diameter at bottom of thread, D outside diameter, and n the number of threads per inch. Applying the formula to our No. 8 screw, and supposing it to have 30 threads per inch the formula becomes $.163'' - \left(\frac{1.733}{30}\right)$, which gives .1056″ as the size at bottom of thread. Two thirds to three fourths the depth of the thread is generally considered about right for cast iron.

(182) J. A. A., Terre Haute, Ind., asks: How large a steam pipe will be required to furnish steam to an engine with two cylinders; each cylinder is 20 inches diameter, stroke 48 inches; speed, 75 revolutions per minute? I have examined a number of your papers, but failed to find rules for the above. *A.*—The diameter of steam pipe leading to each cylinder is found by the following rule: Divide the diameter of the cylinder in inches by 90, and multiply the quotient by the square root of the piston speed in feet per minute, the product will be the diameter of the steam pipe. Or, if D represents the diameter of the cylinder in inches, S, the piston speed in feet per minute, we have $\frac{D}{90} \times \sqrt{S}$. The piston speed of your engine is 600 feet per minute, hence the diameter of the steam pipe will be

$$\frac{20}{90} \times \sqrt{600} = 5.39, \text{ say, } 5\tfrac{3}{8} \text{ inches.}$$

The area of the steam-pipe from the boiler supplying the two steam pipes to the cylinders should be twice the area of the steam pipe as found above. The area of a pipe $5\frac{3}{8}$ inches diameter is 22.69 square inches, hence the area of the main steam pipe should be,

$$22.69 \times 2 = 45.38 \text{ square inches,}$$

the corresponding diameter is $7\frac{3}{8}$ inches, nearly. The above gives good results for short steam pipes; if these are comparatively long, their diameters should be somewhat increased to allow for friction

(183) A. C., Kokomo, Ind., writes: Please describe the process and also things necessary for drawing temper in large quantities of bits or cutters. Which is the best way to anneal steel in bar lengths? *A.*—We referred these questions to Mr. B. F. Spalding, who replies as follows: The best way to draw the temper on small articles, as bits and augers, is to immerse them in a fluid of the right temperature and allow them to remain until all have the same heat. A tank of oil regulated by a thermometer is good for any heat less than will blaze oil. Many combinations may be made with vegetable, animal and mineral oils and tallows with beeswax, rosin, salt, soda, etc., to suit any purpose. Even temperature in any fluid must be secured by agitation if not boiling. With skill sand may be used in place of a fluid; skillful handling will let the air to them and bring out any colors that are wanted. Bits may be bunched and augers set in frames so that a number of them can be handled as one piece. To anneal steel in bar lengths, the best way is to have a well-constructed furnace or muffle of sufficient capacity to receive the bars and heat them slowly. Softness is secured by prolonging the time of cooling from a red heat to a first blue. It is not good practice to heat steel in a hot fire, neither to heat in a slow fire if it has access to air. Extemporized furnaces should be clayed air tight, be under perfect control and closely watched. Overheatings are practically irremediable. A good practical blacksmith can anneal bars of steel in a forge fire by setting up a table behind the forge on which the anneal is banked. The end of the bar is put in the fire, and as fast as a portion is heated it is shoved along into the anneal. When the whole bar is heated it may be transferred to any pit of hot lime, ashes or sand, or of fine dry charcoal or of dry sawdust. Air should be excluded.

(184) J. M., New York, writes: I have read in the press of the country on different occasions that a polished steel disk 6 inches diameter and 1 inch face, running at a speed of 6,000 revolutions per minute, will cut through any kind of metal. If such is the case I would like to know if a larger or smaller disk could not be used with like results; also who is the manufacturer of the machine? *A.*—Disks are frequently used for cutting metals, but we have not seen a disk 1 inch thick used for the purpose. For sawing any section of iron while cold the cold saw is sometimes used. This consists simply of a plain soft steel or iron disk without teeth about 42 inches diameter and $\frac{3}{16}$ inch thick The velocity of the circumference is about 15,000 feet per minute. One of these saws will saw through an ordinary steel rail cold in about one minute. In this saw the steel or iron is ground off by the friction of the disk, and is not cut as with the teeth of an ordinary saw. Reese's fusing disk is an application of the cold saw to cutting iron or steel in the form of bars, tubes, cylinders, etc., in which the piece to be cut is made to revolve at a slower rate of speed than the saw. By this means only a small surface of the bar to be cut is presented at a time to the circumference of the saw. The saw is about the same size as the cold saw above described, and is rotated at a velocity of about 25,000 feet per minute. The heat generated by the friction of this saw against the small surface of the bar rotated against it is so great that the particles of iron or steel in the bar are actually fused, and the "sawdust" welds as it falls into a solid mass. This disk will cut either cast-iron, wrought-iron or steel. It will cut a bar of steel $1\frac{3}{8}$ inch diameter in one minute, including the time of setting it in the machine, the bar being rotated about 200 turns per minute. See Appleton's Cyclopedia of applied mechanics. These machines you can obtain from any dealer in machinists' tools and supplies.

BUSINESS SPECIALS

Transient Advertisements 50 cents a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue.

Grant Gears. Lexington and Phila. See page 11.

Shafting Straighteners. J. H. Wells, Tampa, Fla.

Ideal Drawing Stands. M. C. Hammett, Troy, N. Y.

Forming Lathes Mer. Mach Tool Co., Meriden, Ct.

Tool Holder: Armstrong Bros. Tool Co., Chicago.

6 Spindle Turret Drills A. O. Quint, Hartford, Ct.

"Bradley's Power Hammers, the best in the world." 20 sizes. Bradley & Co., Syracuse, N. Y.

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"Binders" for the AMERICAN MACHINIST. Two styles—the "Common Sense," as heretofore sold by us, and mailed to any address at $1.00 each, and the "New Handy," mailed at 50c. each. The former has stiff board covers, while the latter has flexible covers with full page opening flat. Either will hold the entire 52 issues of any volume. AMERICAN MACHINIST PUBLISHING Co., 203 Broadway, NEW YORK.

"Indicator Practice and Steam Engine Economy." By F. F. Hemenway. Contains plain directions for using the indicator and making all required calculations from the diagram, also the principles of economy in operating steam engines and current practice in testing engines and boilers. Price, $2 postpaid. Published by John Wiley & Sons, 53 East Tenth Street, New York.

Foundry Talk.

BY CHARLES SMITH.

Making the cores for long plungers and cylinder molds, to be cast on end, is a branch of foundry practice that calls for special attention, and for so much different treatment from the ordinary loam core making, that a few words on the subject may be of interest. Ordinarily on pipe work or cylindrical work, the spindle is wrapped with a covering of hay rope, and on this a covering of clay and fine gravelly sand is applied, and the core at one operation built up to almost the required size; it is then put into the oven, and after being dried, is taken

out and a second covering (loam and sharp sand wet with clay wash) called the second coat applied, and after this sets a little, a coat of blacking is given the core, and it is run back into the oven to be dried. So clever does a gang of core makers in a pipe shop become, and so adept in handling rigging and core appliances, that three men will, each day, make complete and place in molds, ready for the iron, one hundred 4″ cores, 12 feet 6″ long, while four men will make eighty-two 6″, or sixty 8″, or forty-eight 10″ cores of like length each day.

This is for ordinary pipe work where the thickness of castings runs from ⅝″ to 1″. But where hydraulic pistons and cylinders are made, with a thickness of metal running from 2 to 5″ or more, and from a length of from 15 to 30 feet, experience teaches us that the ordinary pipe core will not answer. If we build the core on a spindle large enough to take the hay rope and then the gravel mixture, we will find, if we place it in the mold and pour a large quantity of metal around it, that the extreme heat will burn out the hay rope before the metal has a chance to solidify, and when the contraction or shrinkage commences, it meets but feeble resistance from the consuming core, and as the pressure is greatest at the bottom of the mold the liquid metal feeds away from the top to the point of pressure, thus leaving a spongy or shrunken top, for such molds are not generally fed either through "churning rod" or "feed head." To avoid all this, we take a spindle, small in diameter, and around this wrap a small ⅝″ hay rope, winding it tightly and snugly; on this we place a coating of core loam about 1½″ in thickness, and our core is then placed in the oven where this, our first coating, is dried, then taken out, and we apply another similar coating of core loam, and this is also dried, and this process of building and drying, one coating upon another, is continued until a core of the required diameter is produced.

If there are any shoulders or projections on the core, where danger might ensue from metal striking such points in pouring, they are thoroughly nailed, and usually the 3 or 4 feet of the upper part of the core near the gates are well nailed; a coat of good heavy blacking is then applied, and the core thoroughly dried; it is then ready for casting, and the successive coatings of core loam make a core rigid enough to withstand almost any strain, and the hay rope being so far away from the molten metal, the metal solidifies before the hay rope commences to burn.

The spindle will of necessity be small in diameter, and may be difficult to get into a vertical position with its heavy load of core loam. Usually this difficulty can be overcome by having a hole drilled through the spindle 6 or 8 feet from the top end, and passing a bar through the opening, and swinging the core from this bar into an upright position, a new hold can then be taken from the top of the core.

When the core is to be of such a length, that to make it all on one spindle would be hardly practicable, two spindles are pieced together to make one complete core. When we first thought of doing this, various were the ways that suggested themselves, and some were talked over and tried, and finally the simple and successful method now in use with us was adopted. The lower or bottom part of core is placed in mold, a ridge of flour dough is run around the top edge, and the second core placed on top of the first one, the dough making a tight joint. Care must be taken that the gas can pass readily from bottom core up through top core. When the top core is keyed down no trouble is experienced where the cores meet. Of course the flask must be jointed above where the cores meet, that the second core may be lowered on the first one, and keyed in position at the mold's joint. The upper part of the flask is then lowered over the upright core. If the mold is lengthy, and the metal has a long drop from the top, a piece of boiler iron cut the shape of the bottom of the mold should be set in the mold where the metal strikes the bottom. Under the plate the mold should be thickly nailed, for it is very rarely that the metal falling does not cut away the plate on the bottom, and if the under surface is well nailed, it will have still greater resisting power against the cut of the falling metal. The boiler plate placed on the bottom of mold ought never be nailed in position, for it is sure to curl with the action of the heat, and if nails are used to hold it in position the chances are that in curling up it would tear out its fastenings, loosening parts of the mold's surfaces and endangering the loss of casting.

Plungers, cylinders, and work of that nature, when requiring a sound finish, ought always be poured with the first metal from the furnace, and that metal ought always to be very hot, for gases and air bubbles will pass more readily through liquid metal than through a dull, sluggish mixture; besides the ladles on the early part of the heat are clean, and the furnace is clean, and if a special mixture is desired, this is the time it can be put in the cupola to best advantage. For such class of work a preponderance of close-grained iron should always be used; the aim should be rather to make the casting close, than open grained, and soft iron should be used sparingly; for a sound casting, close-grained iron is always preferable.

Sometimes, despite all precautions, the casting will be found at the top to have shrink holes, and sometimes this can be avoided by driving 20 penny nails into the mold at the top or flange, letting the heads stick out 2 or 3″ into the mold. These tend to chill the casting at its warmest point, that the casting may all solidify at same time. Another, and I believe one of the best ways, is to throw water on the pouring gates and basin the instant the piece is poured. All observing foundrymen have noticed that immediately after a casting is poured in loam or dry sand, the hot metal wells up through the pouring gates into the basin, as though the metal swelled inside the mold and meeting resistance from the mold's surfaces eases itself by pushing out through the pouring gates. This can be tested by raising the pouring head and flowing a mold through onto the ground, and then stopping for a moment; it will be found that the metal, of its own accord, will start flowing again, quite perceptibly if the casting is a heavy one.

This does not occur on a green sand mold, for the latter mold will strain to accommodate the swell of metal, and the gate on the top will show no very perceptible sign of what is going on inside. Chilling the gates and pouring basin with water has a tendency to hold all metal that enters the mold.

When the metal is through swelling, if it has not life enough within itself to feed back, its density is impaired at the top of the casting, and shrink holes and gas holes are the result.

Some very good loam molders claim that almost any loam mold that comes into ordinary practice will show a casting free from shrink holes or shrink depressions, if the mold is put together rigidly enough to withstand all strains brought against it through the action of the molten metal. It certainly is astonishing, the castings in loam, weighing tons and tons, that are successfully cast without "churning rod," "flow-off," or "feeding riser."

The efforts of the Japanese to "strike" oil by boring in the Japan Sea, 150 yards from shore, are said to have been highly successful. Refineries have already been erected.

Mr. H. D. Cozens, well-known to many of our readers, has been placed in charge, as manager, of the Equitable Life Assurance Society's building at Des Moines, Iowa.

The White Star Steamship Company has sent models of the "Teutonic" and "Majestic" to the World's Fair.

Locomotive Engineering in noting that a smokestack 34 feet by 4 feet had been stolen in Chicago, no trace of the thieves being found, wonders that the parties who got away with the stack did not steal the factory. Perhaps they had in mind the fate of the man who stole a saw-mill and going back for the dam was captured. At least that is the reason for being in the penitentiary which he gave to a minister of inquiring mind and good intentions.

One of the latest efforts of a daily paper to get away with an unfortunate inventor, makes him responsible for having invented and constructed an "osculating" engine.

MANUFACTURES

A boot and shoe factory is to be built in Wellsville.

C. B. Gray, of Ilion, N. Y., talks of building a pulp-mill.

Spaulding & Shepley, West Derby, Vt., will erect a pulp-mill.

The Richards Paper Co., Gardner, Me., will build a pulp-mill.

A new woolen mill is to be erected at Woonsocket, R. I.

Augusta (Ga.) is to have a soap factory with a capital stock of $30,000.

The Keith Paper Co., Turner's Falls, Mass., is making an addition.

Extensive additions are to be made to the Pontiac (Ill.) shoe factory.

About $30,000 has been subscribed for the new Abilene (Tex.) oil-mill.

New machinery is being put into the Chippewa Falls (Wis.) Woolen-mill.

There are plans on foot for starting a shoe factory at Frankfort, N. Y.

A new hosiery-mill is to be built by the Pittman Mfg. Co., at Laconia, N. H.

The Jamestown (N. Y.) Felt-mills have been incorporated. Capital, $25,000.

The St. Croix Shoe Co., Calais, Me., may make an addition to its shoe business.

The Mountain City Woolen-mills, McMinnville, Tenn., will add new machinery.

The Saratoga Victory Mills, Victoria Mills, N. Y., are to add 5,500 new spindles to its plant.

Wesley Bonfield and others are planning for a paper-mill to cost $50,000 at Waldron, Ill.

A new stock company has been organized to manufacture pasteboard at Whippany, N. J.

The Mount Athos Iron Company, of Superior, Wis., has been organized with a capital stock of $500,000.

Hubbard, Hibbard & Warren, of East Rochester, N. H., are making arrangements to increase their factory facilities.

The Grand Rapids Pulp and Paper Co. has recently organized at Grand Rapids, Wis., with a capital stock of $100,000.

A $2,000 stock company has been organized to build a cotton mill at China Grove, N. C. Patterson & Calliher are interested.

The Frank Shoe Co. has been organized at Portland, Me., for the purpose of manufacturing boots and shoes, with $75,000 capital.

The Graham Twist Drill and Chuck Company, Detroit, Mich., find themselves obliged to work 80 hours per week to keep up with orders.

The Desplaines Woolen-mills Co. have been organized at Chicago, Ill., with a capital stock of $65,000, by W. C. Boyden and G. A. Carpenter.

A charter has been secured for the Philadelphia Shoe Manufacturing Company, Port Carbon, Pa. Capital, $30,000; directors, G. W. Wolfe and others.

It is rumored that parties are endeavoring to buy the water privilege and land at Bonny Eagle, Maine, on the Saco, for the purpose of building mills.

A Massachusetts company want to establish a box factory at Waterboro, Me., if the town will exempt the industry from taxation for a term of years.

The Brooklyn (N. Y.) Fire Brick Works has been organized to manufacture fire-clay retorts, fire brick, fire tile, etc. Capital, $100,000; directors, E. D. White and others.

A new corporation has been organized in Lowell, Mass., to be known as the Scandinavian Belting Company, which will establish works in the Swede Village district.

The Bracey Improved Spike Company, of Chicago, Ill., has been formed with capital stock of $100,000. The corporators are M. J. Frost, B. M. Taussig and W. N. Williams.

The Berlin Iron Bridge Company, of East Berlin, Conn., have received the contract for the new rolling mill building from the New Haven Rolling Mill Company, at New Haven, Conn.

A. H. Chadbourn, East Waterboro, Me., whose saw-mill was burned a few months ago, is making good progress with his new mill and hopes to have it in operation by the middle of May.

The James E. Thomas Company, of Newark, Ohio, has been incorporated with a capital stock of $30,000. The new concern proposes to erect a foundry, boiler shop and blacksmith shop.

The Brooks Arms Company have decided to locate their gun factory in Deering, Me. A site has been secured on the Goodrich estate near the Maine Central Railroad, and ground will be broken in a few days.

Parsonsfield, Me., having voted to exempt from taxation an industry at Kezar Falls for ten years, it is expected a woolen mill will be built on Allen Garner's mill site, a quarter of a mile below the present mill.

Morrill & Currier's new coat factory at Waterville, Me., will have sixteen sewing machines, four pressing machines and one basting machine in its equipment, employing 35 to 40 hands. It is about ready to start up.

The Rand Drill Company, New York, issue a very complete catalogue of air compressors, drills, etc., made at the works. The catalogue is finely gotten up, and is, we believe, intended for limited distribution only.

The Muncie Electrical Works, Muncie, Ind., is a new concern engaging in the manufacture of electrical specialties, having purchased an entire outfit of tools from the Lodge & Davis Machine Tool Company, of Cincinnati, Ohio.

Sayles & Jenks may erect a large woolen-mill at Warren, Mass. The capacity of the new factory to be about 35 sets of machinery, or about three times that of the former mill. The building will be about 300x50 feet, and be of brick.

Frank R. Conant, Auburn, Me., whose box factory was burned last winter, has now in process of construction a larger factory than the old one, to be erected on the same spot. The structure is being framed and will be erected as soon as the season will permit.

William Tod & Co., of Youngstown, O., are erecting four engines for the Pennsylvania Steel Company, two for a tin plate plant at Niles, O., and are also erecting other heavy machinery on contracts. Their order book is well filled, which means steady work for a long time.

Boston capitalists have purchased an interest in Mount Misery, a long range of mountainous ridges in Jonesboro, Me., and it is reported will conduct a large granite operation there the coming season. There is an inexhaustible supply of granite, of good quality and excellent rift.

The Wells Machine Works, Fostoria, Ohio, manufacturers of pipe threading machines, have consolidated with the Merrell Mfg. Co., of Toledo, Ohio. The Merrell Company are putting in new machinery, have doubled their force, and are working day and night to fill orders. Mr. Wells has personal supervision of their manufacturing department.

A certificate of the incorporation of the Union Paper-box Manufacturing Company was filed recently at the New Jersey County Clerk's office. The incorporators are Samuel J. Smith, James W. Mercer and John F. Royle, and the capital stock is $2,400, of which $1,200 has been paid in. The business will be carried on in Passaic City, N. J.

There is water-works agitation at Norwood, O.; Canton, O.; New Orleans, La; Danbury, Conn.; Silver Cliff, Colo.; Santa Rosa, Cal.; Fort Valley, Ga.; Laredo, Tex.; Fort Edward, N. Y.; Malvern, Pa.; Chandler, Okla.; Lander, Wyo.; Winside, Neb.; Astoria, Ore.; Washington, D. C.; Delaware, Wis.; Seattle, Wash; Elkins, W. Va.; Frederick, Md.; Logan, Utah; Lagrange, Ind.

Fryeburg, Me., has unanimously voted to loan its credit for $12,000 in aiding the Fryeburg Manufacturing Company to establish a plant for a chair factory to be located in the village. A butter factory is also being strongly talked up, and it seems likely that the farmers will take hold of this business and establish a convenient center to market the great amount of cream made in and around Fryeburg.

The New England Sulphite Digester Company have purchased the carbonized cement plant of John Littlefield & Co., of Bangor, Me., and will carry on the business of making digester linings there. T. W. Baldwin will retain his position as superintendent of the factory. The linings made for the digesters of the Orono Pulp and Paper Company during the winter are now being placed in position.

The Builders' Iron Foundry, of Providence, R. I., has shipped to Chicago a 36-inch Venturi meter manufactured under the patents of Clemens Herschel, C. E., New York City. This meter will be placed in the extreme southeast corner of the grounds and will measure the entire water supply of the Columbian Exposition (about 24,000,000 gallons a day). The recording apparatus will be exhibited in the adjacent building of the Sewage Cleansing Works.

The Fowler Car Company, of Brooklyn, N. Y., has purchased two large tracts of land on Third street, Elizabeth, on which to erect its works, and plans have been drawn for thirteen brick buildings. The plant will be located on both sides of Third street, the main works to be on the west side of the street. It is expected that the works will be ready for operation by Thanksgiving Day, as the company is anxious to take possession before the 1st of January next. They will give employment to about 800 men.

The Eagle Pattern and Model Company, Messrs. Huther & Finot, of St. Louis, Mo., are very busily engaged on patent wagon hubs, draw bars and

hand trucks, or "railroad bicycles," as they are dubbed in the pattern shops. These latter are intended for very high speed, and are decidedly novel in construction. This company are now about to enlarge their capacity; they have secured two rooms fronting the shop now occupied, and will increase their working force and put in new tools to keep up with the expansion of their business.

J. A. Fay & Co., Cincinnati, Ohio, have issued what is probably the most comprehensive catalogue of wood-working machinery yet published. It consists of 337 large pages finely bound in an embossed cover. The paper is of excellent quality, the engravings first-class, and the printing artistic. The great variety of wood-working machines illustrated and described in this catalogue will make it especially valuable as a work of reference. It is fully indexed, enabling the user to turn to cut of any machine illustrated without delay. It also contains a telegraph code.

The shops of the Central N. Y. & Western R. R., at Angelica, N. Y., are to be enlarged. Some $20,000 worth of new machinery, including a 60 horse-power boiler and engine are to be put in, and they will be able to do all the heavy work on locomotives. M. S. Blair is the new superintendent, and he will spare no expense to make these shops A1, in every respect. The C. N. Y. & W. is going to extend its road into the coal and lumber region of Pennsylvania. It is expected that cheap coal and lumber, healthy climate, good educational facilities, etc., will induce manufacturers to locate there.

A. J. Corcoran, 76 John street, New York, manufacturer of wind-mills, pumps, water tanks and water supply materials, has received an order from London for a complete outfit of his machinery for building tanks. The London company has adopted Mr. Corcoran's system of water supply for suburban residences, and several of his mills have already been shipped with good prospects of further business. Mr. Corcoran's system and machinery was adopted after the manager of the London company had made an extended investigation in various parts of this country. Mr. Corcoran's factory is in Jersey City.

The Auburn (Me.) Electric Motor Company has just been incorporated under the general law with a capital of $50,000. The company have bought the Litchfield carriage factory building near the railroad bridge in Auburn, and will proceed at once to fit it up for their business. This building is 40x65 feet, two stories high, and has four floors. Messrs. Lucas & Brown, who recently began the making of motors in Auburn, which has led to the formation of the above company, have been rushed with orders from the outset. The outlook is encouraging for a large and lucrative business. This plant will add another industry to Auburn's growing list.

The Boston Toothpick Manufacturing Company, after looking about some time for a suitable site for their factory, have decided to locate in Deering, Me., having purchased the old tannery lot at Morrills Corner. They will build at once, and hope to have the factory ready for business in about two months. They have leased the Chase & Son plant with which to prepare their machinery, and their castings are being made by the Portland Foundry and Machine Works. It is understood that the company have purchased a large tract of woods a few miles up on the Maine Central line which will furnish sufficient wood for a number of years. When the factory is ready for work it means the employment of about sixty hands.

The Saco and Biddeford (Me.) Creamery Association have opened their stock book, and are now receiving subscriptions. The capital stock is $9,500, and quite an amount has already been pledged. The directors of the association expect that the creamery building will be ready for occupancy soon after May 1st. Both milk and cream will be bought, and separators will be used which will take care of all that can be furnished from that vicinity. Arrangements have also been made to run a milk train down from North Berwick, gathering milk at Wells and Kennebunk. The creamery will be fitted with the most modern and improved machinery, and a manager who has had years of practical experience in the business, and has the reputation of being a hustler, has been engaged.

Machinists' Supplies and Iron.

NEW YORK, April 8, 1893.

Iron—American Pig—We quote Standard Northern brands, No. 1 Foundry, $14.50 to $15.25; No. 2, $13.50 to $14.25; Gray Forge, $12.75 to $13.50. Southern brands of good quality are obtainable at $14.25 to $14.75 for No. 1 Foundry; $13.25 to $14 for No 2; and $12.25 to $13 for Gray Forge.

Antimony—The market is steady. We quote L. X., 10¼c. to 10½c.; Cookson's, 10½c. to 10¾c.; Hallett's, 10.10c. to 10.20c., and U. S. French Star, 10½c.

Copper—The market is dull. Lake Copper for prompt and future delivery is quoted at 11¾c. Casting Copper is held at 10.60c. to 10.80c.

Lead—The market is firm; some business is reported at 4.10c., and that price will still buy.

Lard Oil—Prime City is quoted at 84c. to 85c.

Spelter—There is no change in the market, 4.30c. is still quoted for New York delivery. Sellers entertain firm views, but there is a lack of demand.

Tin—The prices are declining; spot and April deliveries can be bought at 20.50c. A sale of 25 tons May delivery is reported at 20.60c. net cash.

✻WANTED✻

"Situation and Help" Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Wanted—Salesmen on commission, to push a special line of mach'y. "Kirk," care of AM MACH.

Wanted—Machinery molders; steady work. Gardner Governor Co., Quincy, Ill.

Wanted—A pos. as tool & die maker, 10 yrs'. exp., strictly sober and reliable. Box 83, AM. MACH.

Wanted—A position as foreman or pattern maker, 20 yrs. exp., builders' hardware. E. B., AM. MACH.

Draftsman—Machinist with 2 years' drawing office exp., desires position. Box 85, AM. MACH.

Wanted—Position by young draftsman with some exp. as ass't; country pref'd. Box 88, AM. MACH.

Draftsman—7 yrs. shop & drawing wants position. Mach. tools, cranes, marine engs. Mac, AM. MACH.

A competent mech. eng. and supt. of large experience in shop matters would like a position May 1. Address Brown, AMERICAN MACHINIST.

Wanted—An exp'd mech. draftsman for temporary work. State age, exp. and salary wanted. The P. H. & F. M. Roots Co., Connersville, Ind.

Wanted—Pattern makers on heavy machinery work. None but 1st class workmen of good habits need apply. Farrel F'd'y & Mach. Co., Ansonia, Ct.

Wanted—Foreman for machine shop; fifty hands; engine building and general iron work. Address, with references. Box 66, AM. MACHINIST.

Wanted—Situation by mech. draftsman, six years' experience on machine tools and special machinery. Good ref. Box 87, AM. MACHINIST.

Wanted—One good pattern maker and a few good molders; only competent men need apply. Miller Steam Pump Co., Dixon, Ill.

An expert mechanic and inventor would like a position with a progressive company. Can furnish several small articles to manufacture, covered by recent patents. Jones, AMERICAN MACHINIST.

Young man, 21, technical graduate, with some shop exp., desires position with engineering or contracting firm. Box 90, AMERICAN MACHINIST.

Wanted—A mechanical engineer, a graduate who has had some shop exp.; also 2 mechanical draftsmen exp'd in general engine and machine work. F. W. E., Room 40, Coal Exchange, Scranton, Pa.

Foreman Wanted—Who can rub men the right way to increase production and do good work. One familiar with high grade engines desired. H. G., P. O Box 1001, N. Y.

Foreman in iron foundry, one familiar with all kinds of light and heavy machinery in green dry sand and loam; best of references from last employer. Address C., AMERICAN MACHINIST.

Mech. engineer wants situation as supt., assistant supt., or chief draftsman. 15 years' practical experience on machine tools, eng. and electric machinery; best refs. Theory & Practice, AM. MACH.

Wanted at once—A machinist, good scraper and vise hand. Steady place for the right man. Address or apply Faneuil Watch Tool Co., Boston, Mass., B. & A. R. R. Faneuil station.

Foreman patternmaker, age 32, 10 years' experience on machine tool, gearing and special machinery, and some exp. in drafting, desires situation, best of refs. Box 80, AMERICAN MACHINIST.

Foreman desires change July 1. Experience covers machine tools, pumping machinery, Corliss and high-speed engines, general jobbing and mill work, age 33. Box 84, AMERICAN MACHINIST.

A practical man in mach. shop and foundry, can mix iron on analysis, wants position as supt.; can give best of refs., will guarantee to save salary on the mixture of iron alone. Box 79, AM. MACH.

Tool maker, steady, 34, used to the making of cutters, shell reamers, dies, taps, etc., and hardening of same, fairly well posted in latest improvements in machine tools, prices, etc., position wanted. Address Box 81, AMERICAN MACHINIST.

Mechanical engineer, specialty steam machinery, exp'd in shop, drafting room and testing of all kinds, would like position with consulting eng. or would take desirable position as foreman or draftsman. Address K., AMERICAN MACHINIST.

Draftsman—Young man, 7 yrs. exp. as a mach., has good technical education, quick at drawing and calculating, with moderate drawing office experience, desires position as assistant or on details. Box 86, AMERICAN MACHINIST.

Position wanted, with a progressive concern, by an educated mech. who has large experience in designing and building machine tools, engines and general machinery. Position as designer or superintendent preferred. Box 89, AM. MACHINIST.

Wanted—A foreman mach. for about 75 men, exp'd on steam eng. and pump work, must get out work systematically and expeditiously; handle men and tools to best advantage. State full exp. & wages expt'd. Foreman Machinist, AM. MACH.

Wanted—Member A. S. M. E., superintendent of large works, desires similar position in Philadelphia about June 1st. 18 years exp. covering machine tools, general machine and iron work, & electric railroad & lighting mach'y. Box 59, AM. MACH.

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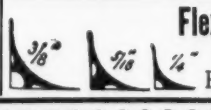

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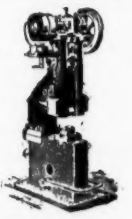

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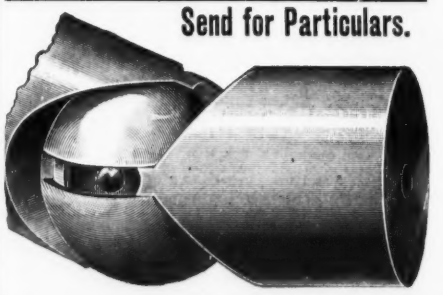

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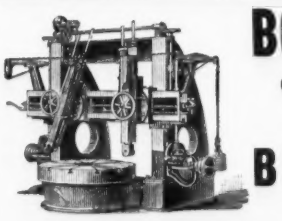

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✻WANTED✻

"Situation and Help" Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Wanted—Position as draftsman or assistant superintendent in a Corliss engine mfg. establishment six years prac'l exp. as pattern maker and erecting engineer and worked a number of years in drawing room and is thor. acquainted with the principle of compound & single Corliss eng. O. M., Am. Mach.

Wanted—A live man with good address, experienced in general steam plant work, to represent an old established business in and about New York. A good opening for the right man. State age, experience and remuneration expected. Mechanical Engineering, American Machinist.

Wanted—A competent, energetic foreman; must be a pusher and a man of good habits, familiar with the best practice on lathe press and milling machine work, looking after about twenty men; also draftsman having experience in designing milling machines and special tools, jigs, etc.; state age, experience and wages exp'd, R. W., Am. Machinist.

✢ MISCELLANEOUS WANTS ✢

Advertisements will be inserted under this head at 35 cents per line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Cheap 2d hd lathes & planers. S. M. York, Clev'd, O

Best Steel Flue Scrapers. Kelley Co., Erie, Pa.

For Sale—Second-hand drill presses, engine lathes and planers. Dietz, Gang & Co., Cincinnati, O.

Light and fine machinery to order; Foot Lathe Catalogue for stamp. E. O. Chase, Newark, N. J.

Best Bolt Header in the world for $50. Address C. H. Baush & Sons, Holyoke, Mass.

Wanted—Machinery and specialties to build. P. G. Fleming's Machine Works, Elizabeth, N. J.

Boiler, vertical, and engine 12 H. P., $155. Screw-cutting lathe 17" swing; bargains. 229, Am. Mach.

Wanted—A Medart shaft straightener; must be in A1 cond'n; state cap'y. Address Shafts, Am. Mach.

Wanted—A fine set of standard size drawings for a modern type of Corliss engine. Address Box 82, American Machinist.

For Sale—Condenser beam engine, cylinder 36"x 7', air pump condenser, etc., complete, can be seen at Front and Pearl Sts., Brooklyn, N. Y., Brooklyn Brass and Copper Company.

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For Sale—A complete set of patterns & mounted drawings for a 16" swing engine lathe, of 1st-class modern design, also lot of jigs and special tools for building same; photos on application. Also on hand 24"x24"x8' friction drive, Putnam planer. 15"x8 engine lathe with grinding attachments, etc., 32" Whiton gear cutter. Address Modern, American Machinist.

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16 in.x6 ft. New Haven, Rise and Fall Rest; A1 order.
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17 in.x8 ft. Blaisdell, Rise and Fall Rest; Good as new.
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26 in., raised to 29 in.x10 ft. Perkins, Plain Rest; A1 order.

PLANERS AND SHAPERS.

24 in.x24 in.x6 ft. Pease Planer; A1 order.
30 in.x30 in.x8 ft. Hewes & Phillips very fine tool; Good as new.
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37 in.x40 in.x9 ft. Enterprise Machine Co.; Good order.
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36 inx36 in.x9 ft. Whitcomb; A1 order.
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No. 3 Pratt & W. Screw Machine, Plane; A1 order.
No. 3 Windsor Screw Machine automatic chuck, wire feed, complete; Good as new.
No. 4 Garvin Geared Milling Machine; A1 order.
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One No. 3 Stiles Power Press; A1 order.
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33 in.x27 ft. " "
32 in.x12, 14, 16, 18 ft. Bed. New Engine Lathe.
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25 in.x12, 16, 20 and 24 ft. Bed. New do do
21 in.x10, 12 ft. Bed. do do do
20 in.x 5, 6 & 8 ft. do 2d Hand do do
18 in.x 6, 7 & 8 ft. do New & do do do
17 in.x 8 ft. do do do do
16 in.x 6 & 8 ft. do do do do do
15 in.x 6 & 8 ft. do do do do do
14 in.x 6 ft. do do do do do
Car Axle Lathe, Bement. | Driving Wheel Lathe 88 in.
15, 16, 18, 25 in. Crank Shapers. | Wheel Quartering Mach.,
20, 24, 25 & 30 in. Geared Shapers. Double.
20, 22, 24, 28, 30 & 36 in Drills. | No. 0 Turret Lathe,
Bolt Cutters. | Am. Tool and Mach. Co.,
8 and 13 in. Stroke Slotters. | 24 in. Swing, 8 ft. Bed.
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100 lb. Steam Hammer. | SEND FOR MARCH LIST.
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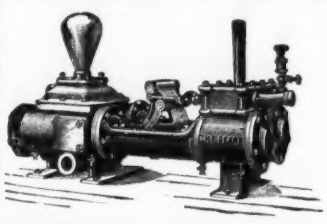

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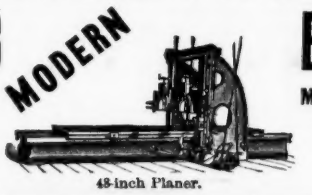
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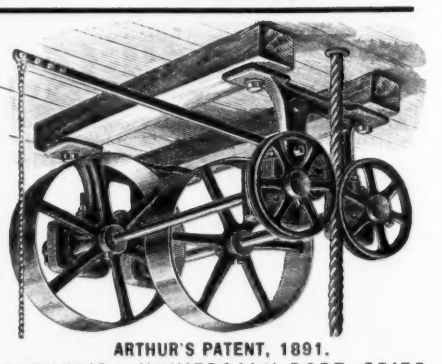

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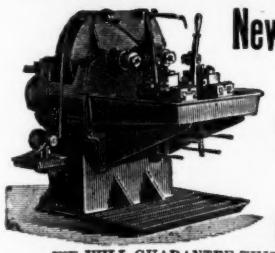

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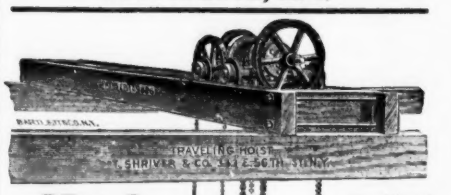

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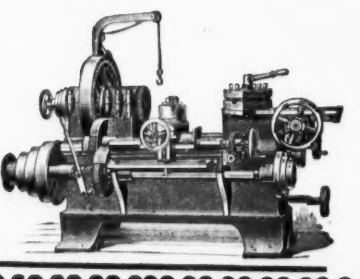

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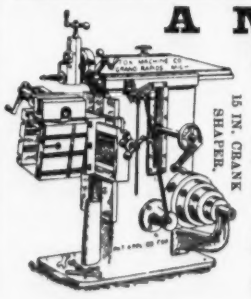

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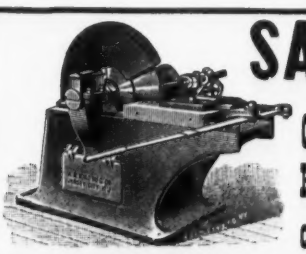

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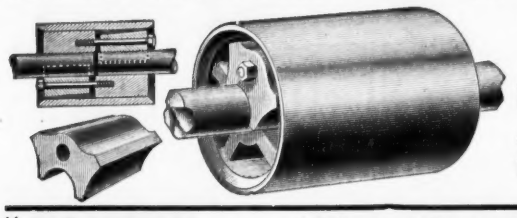

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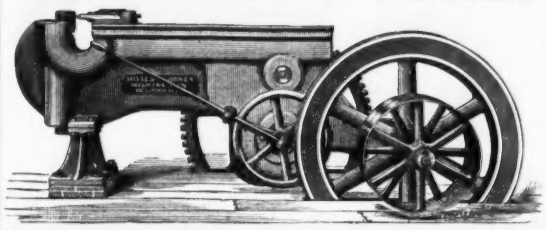

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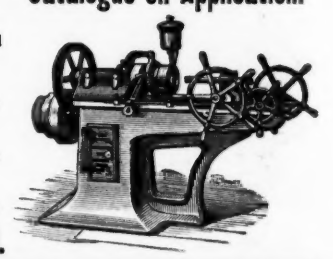

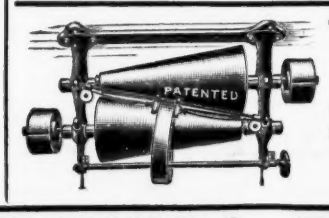

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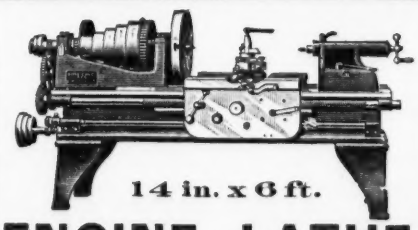

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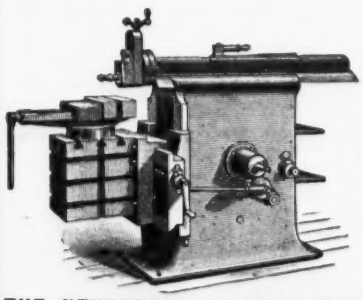

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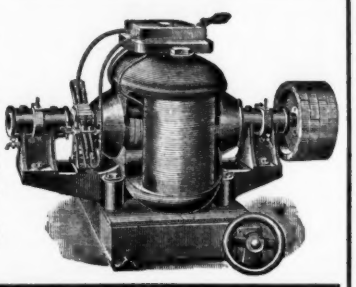

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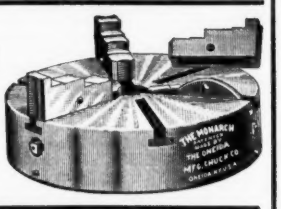

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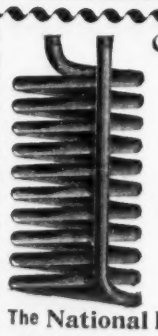
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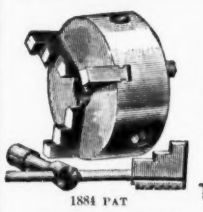
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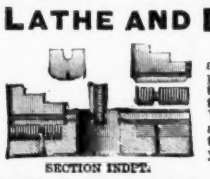
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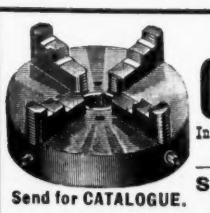
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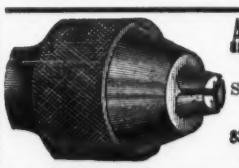
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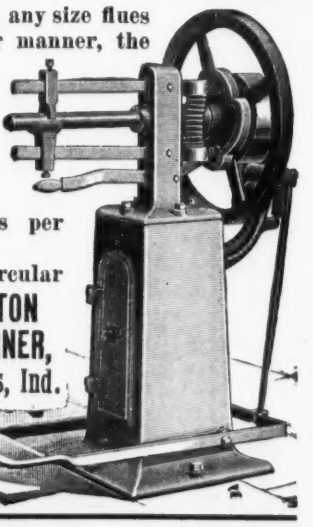

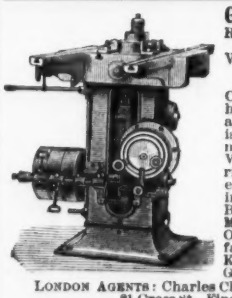
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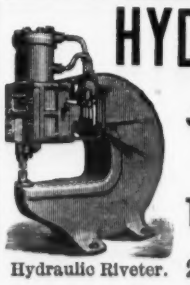
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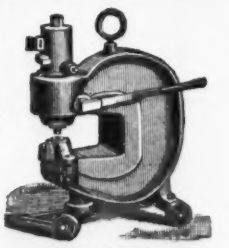
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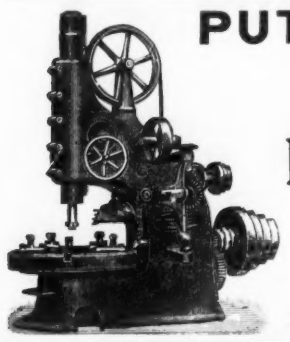

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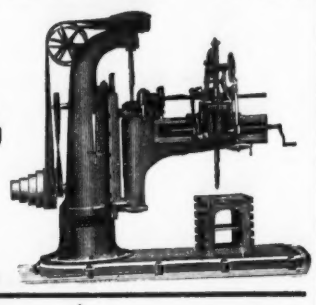

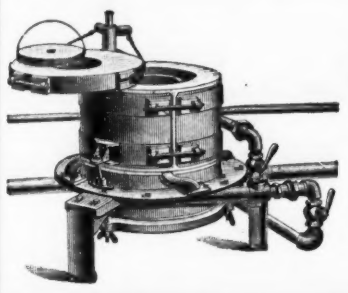

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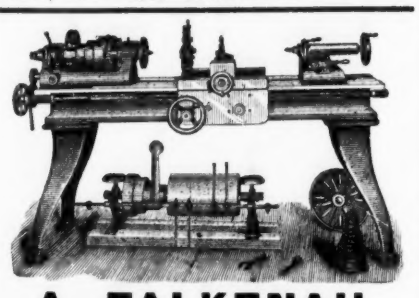

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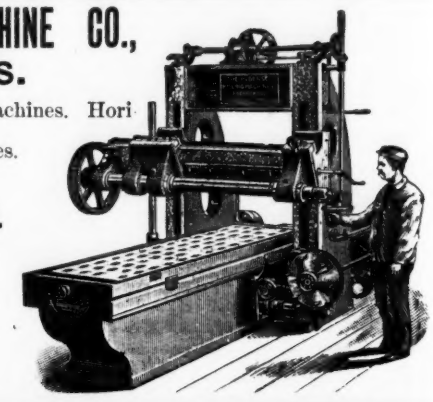

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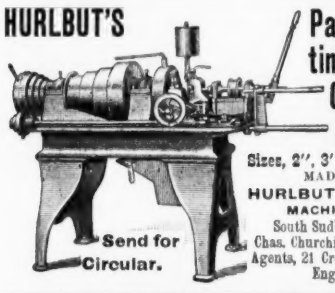

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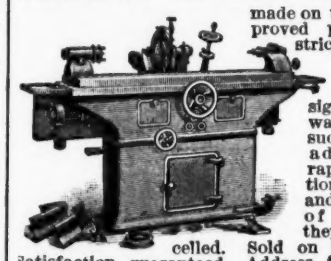

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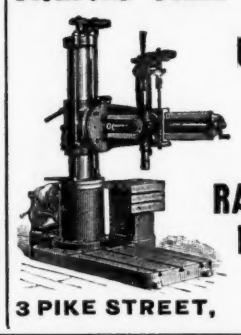

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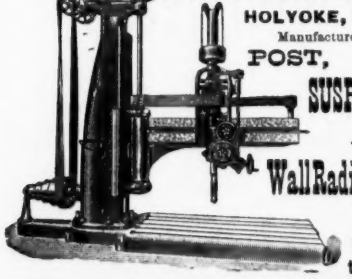

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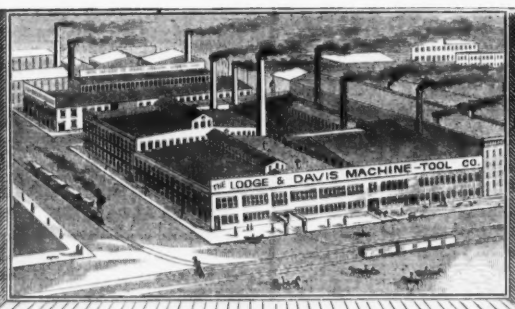

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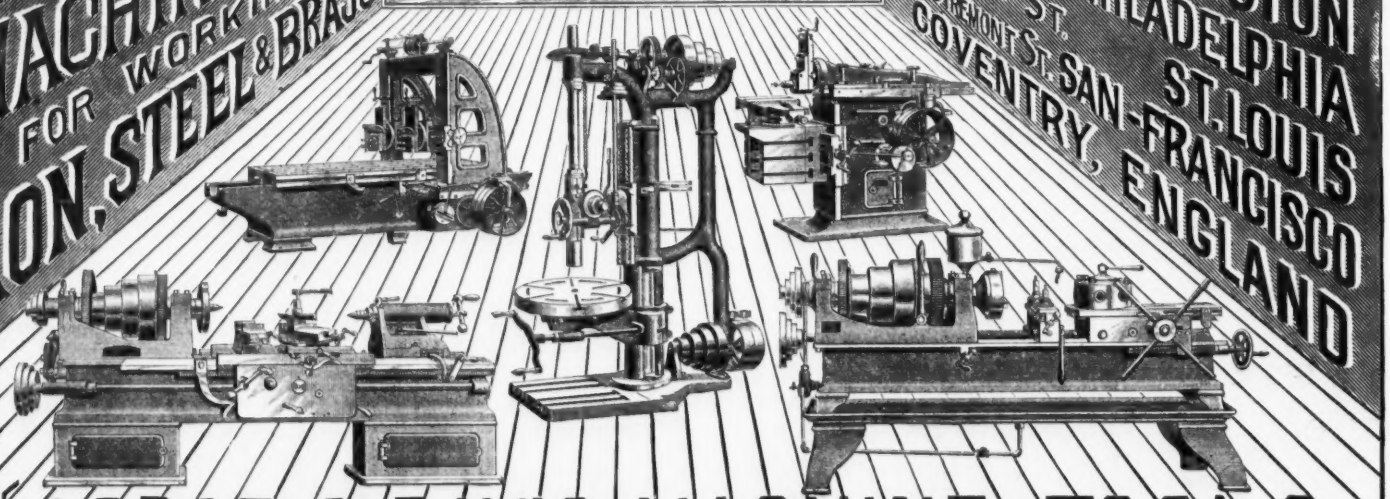

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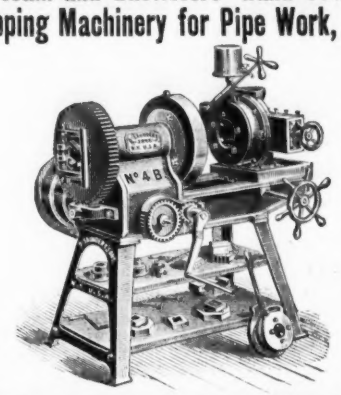

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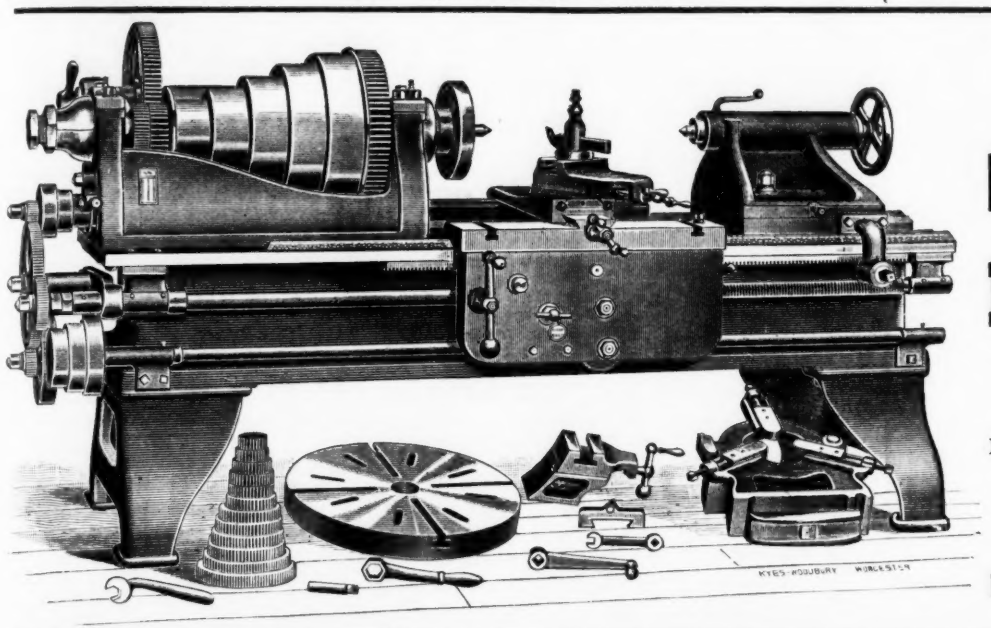

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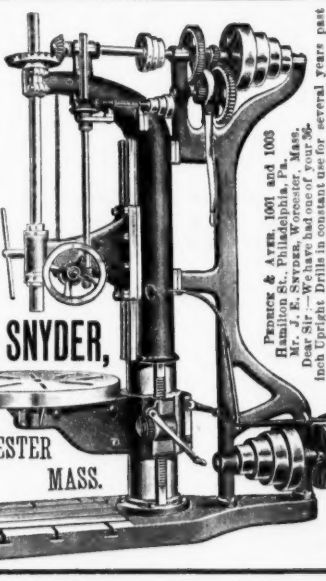

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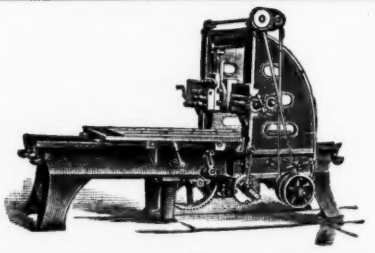

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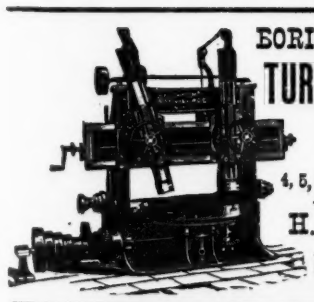

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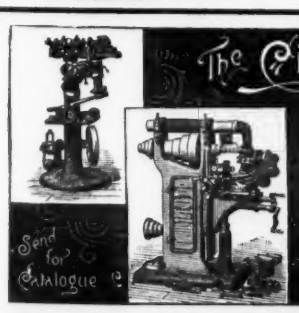

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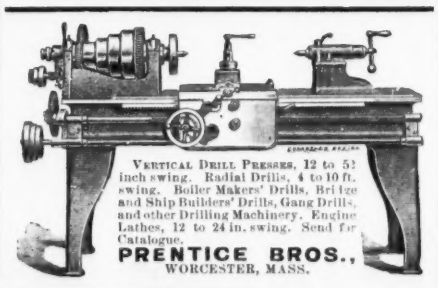

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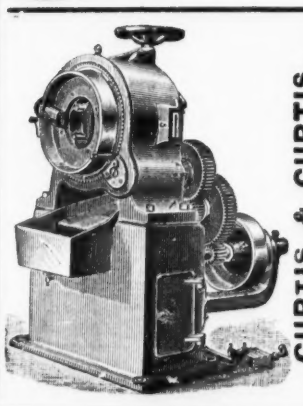

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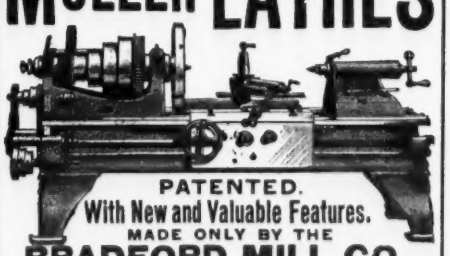

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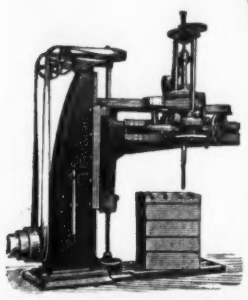

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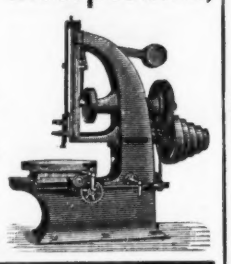

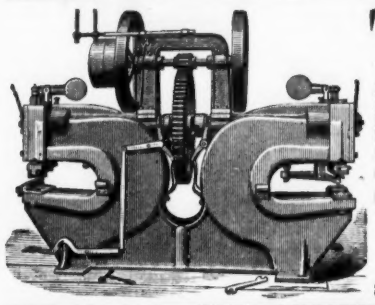

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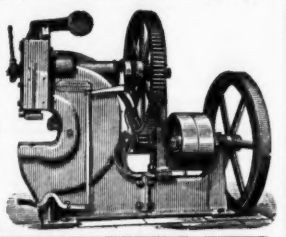

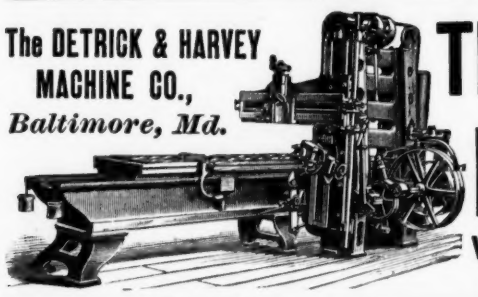

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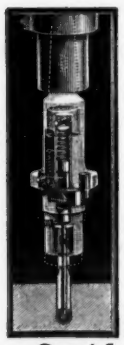

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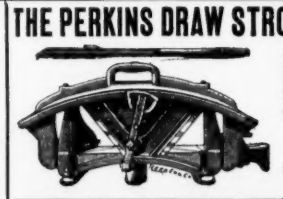

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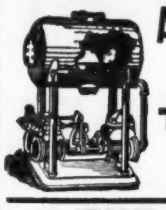

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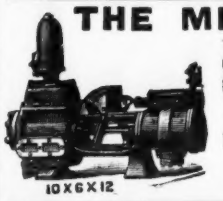

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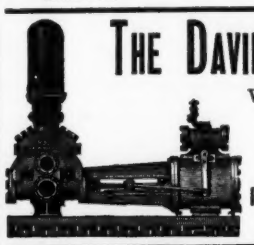

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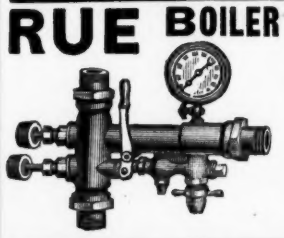

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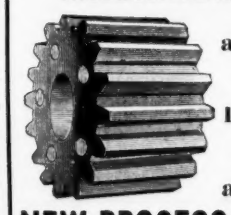

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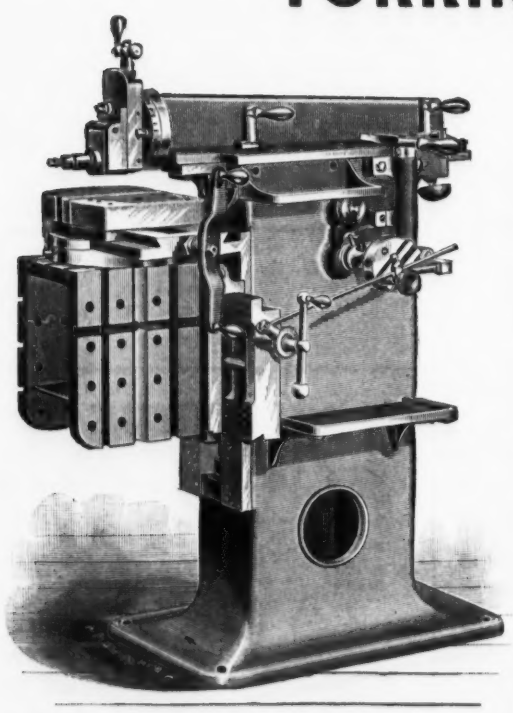

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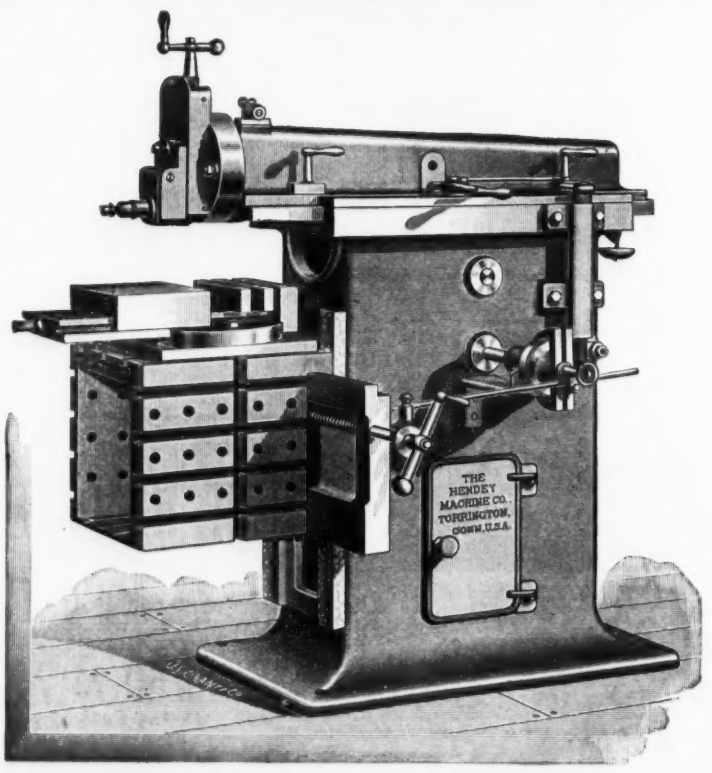

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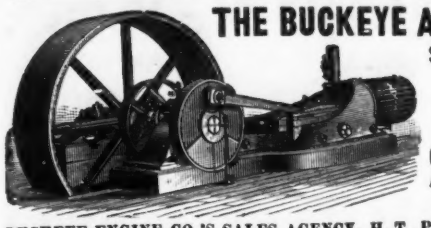

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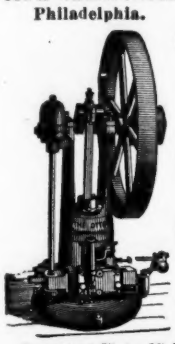

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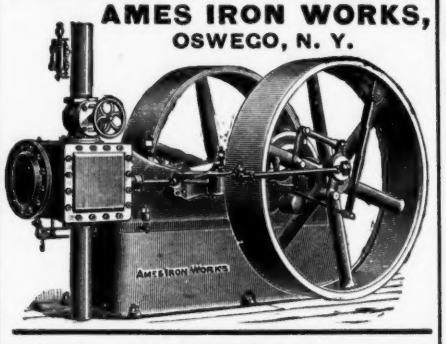

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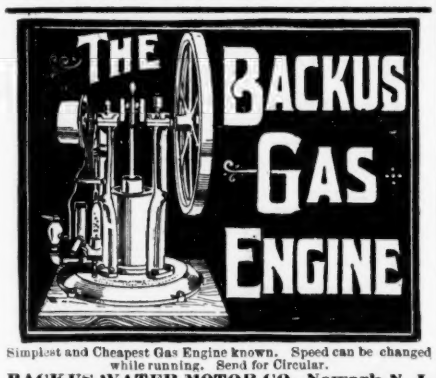

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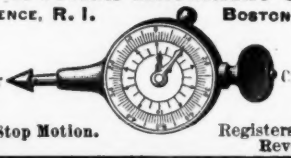
Send for  Circular.

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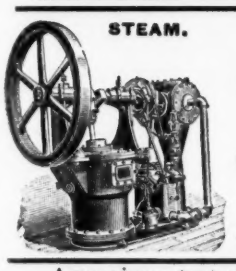

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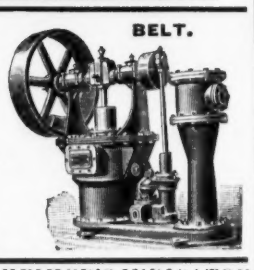

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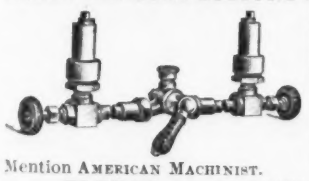

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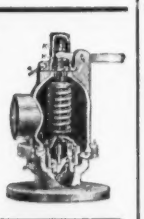

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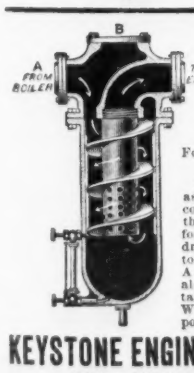

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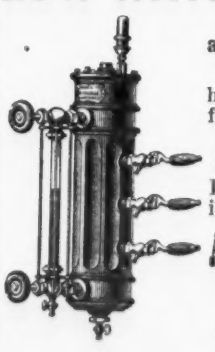

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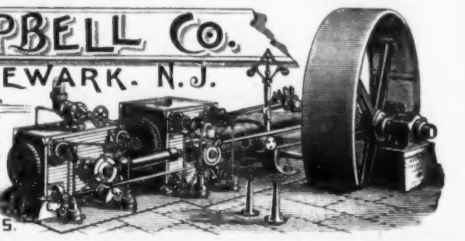

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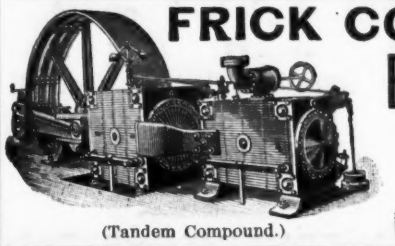

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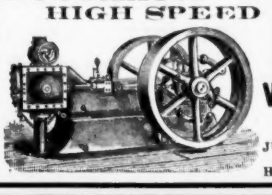

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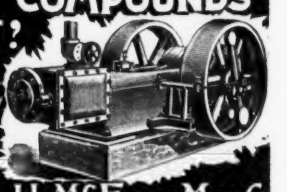

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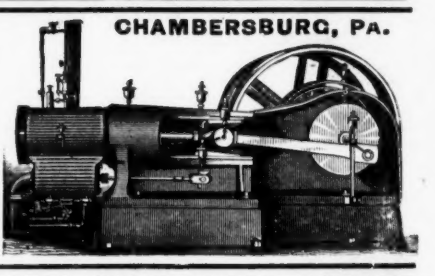

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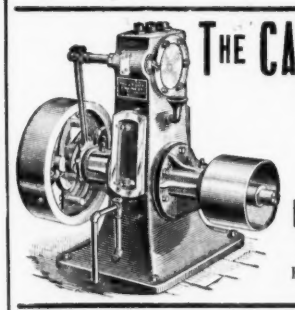

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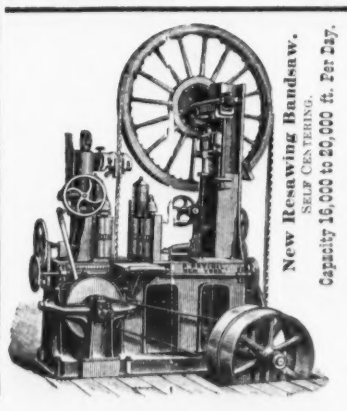

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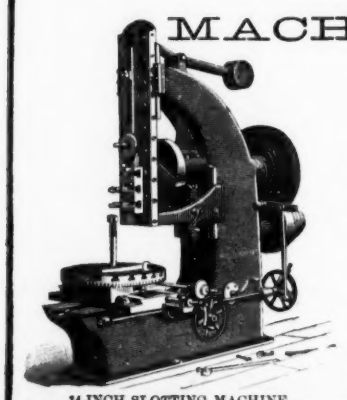
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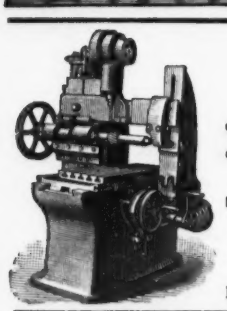

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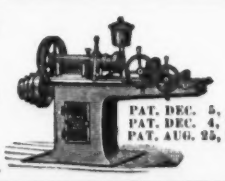
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PAT. DEC. 4, 1883.
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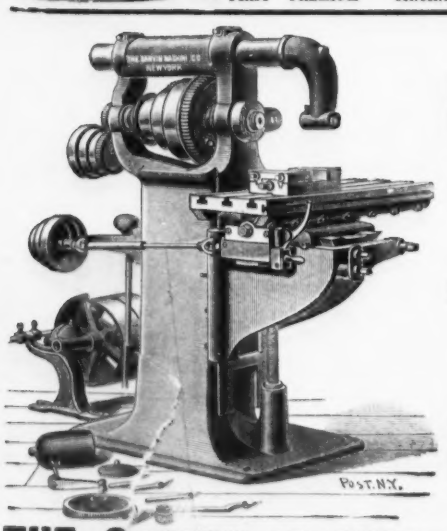

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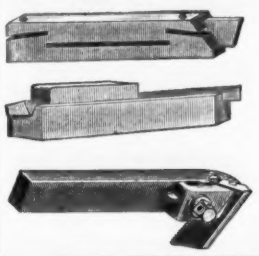

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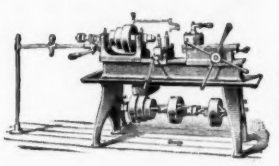

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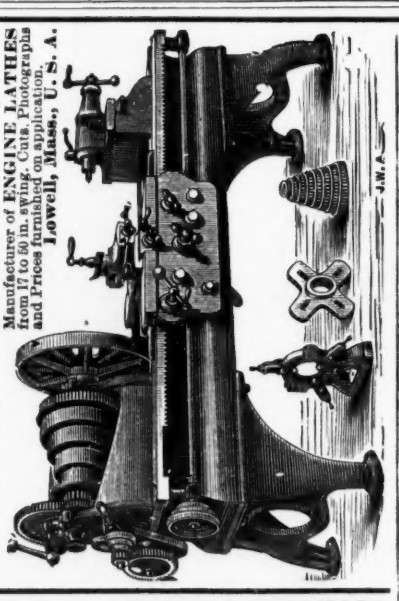

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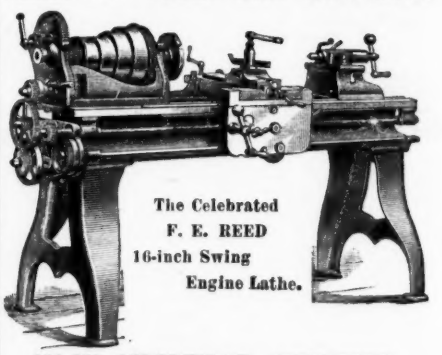
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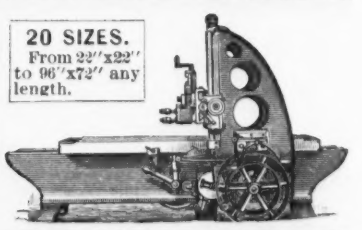

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